RAILROAD GAZETTE

FRIDAY, NOVEMBER 23, 1900.

CONTENTS

Contributions

Lighting the Track.

Beachhaven, N. J., Nov. 14, 1900.

TO THE EDITOR OF THE RAILROAD GAZETTE.

The article entitled "Eyes and Headlights" in the *Railroad Gazette* of October 12 opens up a subject which deserves careful consideration from railroad superintendents. After one has taken a night ride on a locomotive he leaves the engine with a realizing sense of how much the engineer of a night train depends on faith in getting over the road; faith that the track-walker has been vigilant in his patrolling the track, that no fire has burned the stringers of some little bridge, that no broken rail has developed since the last train passed over, that the switches are all set and locked to the main line, that the "extra west" is in to clear, that no vagrant cow has lain down on the track to chew her cud. For it is a fact, as stated in the article before mentioned that distinct vision with an ordinary headlight is limited to about four engine lengths. What wonderful nerve it requires to run a night express train under such conditions. The best possible headlight which art and skill can produce is none too good for night trains, and cost of manufacture or maintenance should not be considered if the light is reliable. But having procured the best electric light, should it not be mounted like a searchlight, so that the engineer may swing the pencil of light to one side or the other when rounding a curve? The beam of intense light will be of little assistance if it points off on a tangent while the track runs around a corner into darkness intensified by the contrast with the illuminated space at one side.

Is it not time to consider the advisability of illuminating the track by fixed lights, as streets are lighted? There are several ways in which this might be accomplished. There are some very efficient gasoline street lamps, with burners of the Welsbach type, some with tanks above the burner, others with tanks in the base of the lamp post, in which case the gasoline is forced up to the burner by compressed air, sufficient air pressure being supplied by pumping up by hand before the time for lighting. Such lamps could be filled, cared for and lighted by the track walker.

Electric lights could be used, the electricity to be supplied by a generator at each water tank, or by a private company when more convenient. When trains are not sufficiently frequent to warrant continuous burning of the electric lights along the whole length of the line a considerable saving in power could be effected by arranging some apparatus by which the approaching train would switch in the lights on a block ahead of it automatically, and at the same time extinguish those behind it. Such an automatic lighting and darkening apparatus could be made to operate reliably and effectively without great additional expense.

I repeat is it not time that the permanent illumination of tracks should be considered, and the probable expense be ascertained? T. A.

The Railway Signaling Club.

The annual meeting of the Railway Signaling Club was held at St. Louis, beginning Nov. 13, President A. M. Keppel, Jr., in the chair. The first business was the admission of a number of new members, including Mr. Shinyiro Yamamoto, of Japan.

There were no annual reports from the officers except the Treasurer's report, which was approved by the Auditing Committee. The balance of cash on hand was $289.

The committee to investigate automatic signal failures due to lightning, which was appointed at the last meeting, made a report summarizing 17 replies received in response to 25 inquiries sent out. Lightning is most severe on signals where there are flowing streams or large bodies of water, and especially where trees grow along the shores; also ravines and valleys where air currents converge. Mineral districts are noticeably affected. The information received concerning arresters and fuses does not afford ground for definite conclusions. Points and magnets are damaged in spite of them, and they are used as much as anything, perhaps, for the purpose of protecting against electric light or other stray currents. There is a diversity of opinion as to whether instruments are ever damaged by atmospheric electricity which comes to them through the rails. Two replies state that no magnets have been burned and three that no relay points have been fused. Of these five cases, two had metallic circuits and one a grounded circuit. In one case where no relay points had been fused and no magnets burned the arresters were connected to the ground with No. 8 and No. 9 galvanized iron wire. In recent installations larger ground wires are being used. The reports of the number of points fused afford no ground for conclusions, as it is not known how many of each kind of points are in use by the roads which reported. The roads which report no failures have but few signals. It appears, however, that plated carbon points are giving good results. Replies indicate that signal wires should be placed on telegraph poles; the expense of a separate line of poles is not warranted. The use of cables, for signal circuits, instead of a line wire on poles is not favored; difficulties from lightning or from malicious tampering are more troublesome where cables are used. The committee, of which Mr. Rosenberg is chairman, recommends that the questions concerning contact points, arresters and fuses be further investigated; also the question whether trunking should be placed above or underground.

This report was accepted and the committee was continued.

The first paper was that of Mr. Adams, which was reported in the *Railroad Gazette* of Nov. 9. The discussion was participated in by Messrs. Elliott (C. M. & St. P.), Rosenberg (L. V.), Denny (C. & N. W.), Gillingham (I. C.), Rhoads (C., C., C. & St. L.), Keppel (P. R. R.), and others. On the question why there is not more progress in signaling a number of members declared that for the last year or two they had been very active in extending their signals; if there was any lack of progress it must be somewhere else. The question whether the economy due to the use of block signals could be mathematically demonstrated was answered in the negative, so far as single track lines are concerned, unless the accident record is taken into account, and that record is one which is not often published, so that no one was prepared to discuss the point except in generalities. That such records ought to impel some roads to put in block signals was illustrated by cases cited. On one road a division of 75 miles long, with steep grades, runs 70 trains a day on a single track, and has collisions so frequently that passenger trains are not expected to be on time. In running such a large number of trains the time limit is, of course, constantly violated. This was given as a recent instance, not ancient history. On one road now using automatics with great satisfaction a certain nine-mile stretch of road formerly distinguished itself by a freight collision about once a week; now the record is two such collisions in six years.

In the discussion of the subject of uniformity Mr. Gillingham spoke of the marked satisfaction, on his road, with the use of advance, home and distant signals at each station. Both the home and the advance signals stand in the stop position behind a train until the block section to the next station in advance is cleared, except that when a following train comes up to within 200 ft. of the home signal that signal clears, so that the train can move forward as far as the advance (starting) signal. The Illinois Central has recently shortened the block sections on a short piece of single track road, making the capacity of the line three times as great as before.

A number of members gave interesting sketches of the organization on their roads, illustrating the duties of the signal engineer and his relation to other officers. On the Illinois Central the signal engineer consults the traveling locomotive engineer before finally fixing the location of new signals.

The subject of uniformity in mechanical details was briefly discussed. With the exception of foundations the speakers believed that out-door connections were now pretty well standardized.

One prominent member declared that the assertion that signal men did not do sufficient missionary work with their superiors, certainly did not apply to his road; signaling is the most lively subject at the monthly meetings of officers, and anything new which is heard of on other roads is promptly investigated. These officers have become so thoroughly convinced that the space interval is superior to the time interval that where they have not yet introduced block signals they have lengthened the time interval for all trains to 10 minutes. Where manual blocking is used (on single track) they allow no permissive signal to be given without a 31 order.

Mr. Rhoads has abolished the somewhat large variety of sizes of lenses on his road and now has only two, 5⅜ in. and 4¼ in. The larger is for signals, train markers, etc., and the smaller for switches. Much progress has also been made in standardizing lamps in other respects. As enginemen are now and then called upon to run over the lines of other roads, it would be a great improvement if all roads could agree on standard sizes (as well as colors) of switch and signal lamps.

Mr. Keppel, in closing the discussion on this paper, called attention to the fact that the Signaling Club is still young and that it should not be severely criticized for not having taken up all of the questions cited by the writer. Mr. Keppel called attention to the question concerning the meaning of the term "caution," which, he said, ought to be discussed. The officers of the Club now have before them the duty of laying out the work for the coming year, and, as at Boston, a year ago, the members should come forward with offers to write papers; and for subjects for these essays Mr. Adams' paper would afford abundant variety. Almost all the questions propounded by him would make suitable topics.

Mr. Adams, replying to a question from the presiding officer, expressed satisfaction with the discussion on his paper. The numerous questions had not been asked with the expectation of getting a certain kind of answers; neither did he deem the questions susceptible of settlement offhand. The drawing out of such numerous and interesting expressions of opinion and statements of experience from the signal engineers of prominent roads was, from his standpoint, sufficient recompense.

At the close of the discussion the meeting proceeded to the election of officers for the ensuing year, which resulted as follows: President, C. C. Rosenberg (L. V.); Vice-President, S. E. Denny (C. & N. W.); Secretary and Treasurer, C. O. Tilton (C., M. & St. P.), West Milwaukee, Wis. Member of Executive Committee, Frank Rhea (Pennsylvania Lines), Pittsburgh. It was voted that for the coming year the Secretary and Treasurer should receive a salary of $150, and Mr. Tilton was thanked for his unpaid services during the past year. After considerable discussion it appeared that it was the unanimous sense of the members present that the next annual meeting should be held in Buffalo, in October, 1901, which will be the last month of the Pan-American Exposition; and a resolution was presented, which lies over until the next meeting, altering the by-laws so as to permit this change in the date of the annual meeting.

Mr. Rosenberg, on taking the chair, made a brief address, in which he recommended that the Club have more committees and thus secure valuable information which cannot be had through the medium of individual essays.

The second session, Wednesday forenoon, was devoted to the discussion of Mr. Rosenberg's paper, which has already appeared in the *Railroad Gazette*. The first speaker was Mr. Elliott, who differed from Mr. Rosenberg as to the location of automatic signals near cross-overs; he would put the signal beyond the cross-over. Mr. Rosenberg called attention to the wording of his paper on this subject and said that he by no means considered it necessary to have an automatic signal near a cross-over; but he would have audible or visual indicators at every switch, to give warning when a coming train enters the *second* block section in the rear; this gives the train and the switch tender equal notice, as with a distant signal for each block section the train gets notice of an open switch at least one whole section in the rear of the switch.

Mr. Sperry, who was unable to be present, sent, in writing, the question "When should the distant signal be placed on a separate post, and when on the same post with the home?" This brought out a long discussion as to what it means to run under control, and concerning the differing practices of different trains, fast and slow, when distant signals are farther back than is necessary to stop the train. The most definite views expressed on this subject were given by Mr. Rosenberg, who has 200 or 300 miles of Hall automatic disk signals, with distants for every block section, and always on the same post with the home. His block sections average 1.4 miles long on one division, about one mile on another, and still less on another. He has but few sections as long as two miles. He finds entire satisfaction with the distant signals these distances back from the home signal. An engineman quickly learns that by following the indications of the distants he can always keep close to a train ahead of him and yet rarely be obliged to stop. If he finds a distant against him, he slackens speed, so as to increase the space between himself and the preceding train; while if he finds it all-clear, he can increase his speed; and with 5,000 to 7,000 ft. in which to make these variations in speed they can be adjusted very nicely. Sections of special passenger trains have followed one another thus for 200 miles without ever being stopped by getting too near the preceding train, while yet the two trains were always about as near together as the length of the block sections would admit. By strict discipline enginemen are kept from taking risks by running too close to a home signal which is against them. The rule requires a full stop of one minute at a home signal showing red; and the train must be run through the next block section under control, even if the engineman can see that the second block section ahead is clear some time before he reaches it.

Mr. Elliott has found satisfaction in the use of auto-

matic signals which are so located as to turn from "all-clear" to "stop" just before the engine reaches them. At this point a desultory discussion ensued as to the value of the overlap as a substitute for the distant signal. One member argued that the overlap was desirable even with a distant signal, as enginemen will make mistakes, or for one reason or another will run past a home signal; but this view was vigorously attacked by several members. If runners must have two warnings to stop why not have them both where he will encounter them before he gets to the home signal? If he will disobey his order to stop at the home he will also disobey the order to stop at the end of the overlap.

One member who argued against spending much money on distant signals, justified his position by the record of his experience with train order signals on single track; but when he admitted that dispatchers' orders were usually put out at the station back of the meeting point when two trains from opposite directions were approaching a train order signal, he was reminded that in fact he was himself using a distant signal. On the general subject of enginemen's obedience of signals, many interesting bits of experiences were given. Maintenance men and battery men, are, or should be, good detectives to report a disobedient engineman. One prominent road marks enginemen with 30 demerits for running past a signal, and for the second offense the penalty is dismissal. On the Lehigh Valley bulletins giving notice that a signal is out of service are not issued unless the disablement of the signal is likely to last several days. For short periods the enginemen (each one) must report the signal as causing a stop.

One member who runs very long and heavy trains on steep descending grades has found that when such trains are stopped the engineman has difficulty in again getting his brakes in hand within less than a mile, and for this reason he raised the question where automatic signals on such a grade should not be always used under permissive rules; that is to say, suspend the rule requiring the engine to be brought to rest when a signal indicates stop; but there was not much discussion on this point. It was stated that on the Boston & Albany and the Central of New Jersey a train finding an automatic home signal indicating stop, need not come to a full stop, provided the way is seen to be clear, but may proceed at four miles an hour (or at some such very low rate). On the Pennsylvania and the Lehigh Valley a stop of one minute is required.

Mr. Keppel took up the question of using a full-sized template in locating signals. He had used a board 6 ft. high, set 6 ft. from the track, with good results. These boards were left standing a month or two and criticisms invited.

On the question of signal bridges there was some discussion whether side tracks should not be moved out so as to avoid setting signals too far away from the main line. Mr. Wileman (L., S. & M. S.) had seen in Chicago a common semaphore post on which a board was fastened, at the side, to take the place of the dummy post used on a bracket, to indicate that there was a track between the signal and the line which it governed. This board is about 10 in. wide and several feet long. Some of the members appeared to favor the use of two posts instead of a bracket post, where space could be found to adopt this plan.

At this point a considerable discussion arose concerning derailing switches though the chair. (Mr. Keppel) subsequently decided the subject out of order. The most pronounced advocates of derails were charged with having lax discipline; if their runners were reasonably careful the derails would not get credit for preventing so many collisions. In Massachusetts, it was stated, derails were being taken out as unnecessary, good discipline being found sufficient to keep enginemen from running through them.

On Wednesday afternoon the members were taken over the Merchants' and Eads bridges and through the yards, as guests of the Terminal Railroad Association. The guides were Signal Engineer Wuerpel and Mr. Chenery, Superintendent of Telegraph.

An Apparatus for Experiments in Impact.*

BY PROF. W. K. HATT AND W. P. TURNER.

A series of tests has been in progress in the laboratory for the past three years to determine the behavior of iron and steel under impact in tension. A temporary wooden apparatus was used for this purpose. The method of testing seemed so promising that a permanent apparatus has been designed and built of iron, with the mechanical details arranged for ease and accuracy of operation. The apparatus has been in operation for two months, and, in the judgment of the writers, is a valuable form of apparatus. In the former wooden machine, Fig. 1, the hammer M was hung to a head attached by wedges to the lower end of the specimen B. The specimen and hammer were lifted by an attachment to a similar head C, fixed by wedges to the upper end of the specimen. On release and consequent descent, the upper head caught on a bridge P between the two uprights. The deformation and the work of deformation were obtained from the velocity displacement curve recorded on the surface of a revolving drum D, by a pencil attached to the hammer M. This temporary apparatus was used to bring about rupture in one blow of an 800-lb. or 1,200-lb. hammer, falling from a height of from 6 to 12 ft. on iron and steel wires, from ⅛ in. to ⅓ in. in diam., and of length up to 10 ft.

The present permanent apparatus is similar to the temporary apparatus in principle. The better adjustment for short specimens is brought about by dispensing with the bridge and constructing the head so as to span

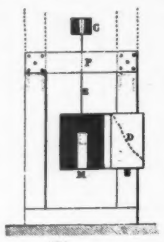


Fig. 1.

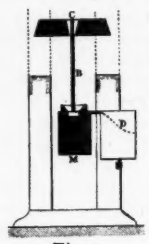


Fig. 2.

the distance between uprights, as shown in Fig. 2. The head or yoke is stopped directly by the columns. The details of attachment of weight, recording apparatus, hoisting mechanism, etc., were made as perfect as possible. The parts were designed to rupture in one blow a test specimen of soft steel ½ in. in diam., and 8 in. between heads. Ordinarily the blow delivered is about 3,500 ft. lbs. Tests in compression are provided for.

As the machine stands in the testing laboratory, its base is partly sunken below the level of the floor, and rests upon a brick foundation 5 ft. x 5 ft. x 6 ft. deep, laid in natural cement on undisturbed gravel foundation; the upper four courses are of paving brick laid in Portland cement. A ¾ in. bearing bed of 1 : 1 Portland cement mortar is disposed between the bed plate and the pier. By reference to the assembled drawing, Fig. 3, it will be seen that the machine consists of a solid cast-iron base, weighing about 5,000 lbs., which supports two cast columns about 12 ft. high, these columns being tied at the top with a cast box yoke. The inner face of each column is planed flat, and acts as a guide for the hammer. Each column includes two parts which are bolted and doweled together, the lower part being a solid casting, 550 lbs., while the upper part is cored to a U-shaped section, 525 lbs. The upper yoke to which the specimen is fastened consists of a heavy steel casting,* 65 lbs., with its ends planed to fit inside the U-shaped column, or guide. In the center is a tapered rectangular opening into which the specimen is fastened by means of wedges. Provision can be made for fastening by using threads and nuts on the ends of the specimen. The lower yoke by which the hammer is hung to the specimen is also a steel casting, with tapered rectangular opening. This is bolted to the hammer with two heavy bolts which are screwed up to an initial tension. The hammer is a casting weighing 515½ lbs., nicely fitted to the guides with little play, and at the same time little friction. A dove-tailed slot is planed in the bottom, into which may be keyed heads of different shapes for making compressional or transverse tests.

For raising or lowering the hammer the hoisting mechanism, shown in Fig. 3, is so designed that the weight may be raised, lowered or stopped in any place desired. This is accomplished by a worm wheel keyed to the shaft, which carries the hoisting drum. On the worm shaft are two friction pulleys running in opposite directions. These friction pulleys are operated by a rocker arm connected to a vertical operating shaft, passing along one column. Springs hold this shaft and the friction pulley in mid-position, the lever being pulled down or up when it is desired to raise or lower the hammer.

For releasing the specimen and hammer from any given height of drop, a special tripping head is used. This head is hooked to the wire hoisting rope, and slides freely between the guides. A bale, suspending the upper head to which the specimen is fixed, carries a hook maintained by a spring to bear on a square pin in the tripping head. When thus engaged the system may be hoisted until the head comes in contact with the stop which has been adjusted at the desired height on the guides. Whereupon the stop will press down the trigger in the tripping head, disengaging the hook, and releasing the system.

The circumstances of each impact are recorded upon a revolving drum by a pencil attached to the hammer. The drum is of rolled sheet metal, supported vertically in an adjustable frame, which may be raised or lowered to the proper height for recording tests of long or short specimens. Ball bearings are used on the lower end of the drum shaft to reduce friction as much as possible and a 50-lb. weight, attached to clock work, furnishes the power for revolving the drum. When used the weight is wound to a certain height, and as it falls the speed of the drum is accelerated until the weight strikes a stop. The speed of the drum remains practically constant during the impact. The speed of the drum may thus be varied and nicely regulated by varying the height to which the clock weight is wound. The exact speed of the drum at the time of the drop is known by allowing a tuning fork with a fine brass point attached to one arm to record its vibration on a piece of metallic paper attached to the upper part of the drum. The recording pencil is operated by an electro-magnet so arranged that as the hammer falls, electric contact is made after the pencil point has passed below the upper edge of the drum. The magnet then draws up an armature, and presses the pencil against the drum.

When it is desired to make tests on long specimens, the upper yoke must be blocked up. This may be accomplished by setting solid rectangular pieces on the lower sections of the columns, thus filling the lower part of the U-shaped columns. These pieces are held in place by bolts. The machine is easily operated and tests may be quickly made. In making a test the operator first fastens the specimen between the hammer and the upper yoke. If wedges are used they are forced into the lower yoke with a pinch-bar, and driven into the upper head with a sledge. By this procedure any noticeable slip of the wedges, with reference to the yoke and any slip of the specimen in the wedges is prevented. The tripping head is then lowered, and hooked on to the yoke. A datum line representing the original length of specimen is drawn on the drum. The system is then raised nearly to the release point at the desired height. The clock weight is then wound to the proper height to give the desired speed to the drum. At the instant the clock weight reaches its stop the system is raised to release. At the same time the tuning fork is brought against the drum to trace its record. To absorb the shock of the hammer upon the base after rupture of the specimen, blocks of pine wood are placed thereon. The operation of placing the specimen in place and bringing about rupture is accomplished in 6 minutes. The time of rupture for the specimens used is 1-100 second.

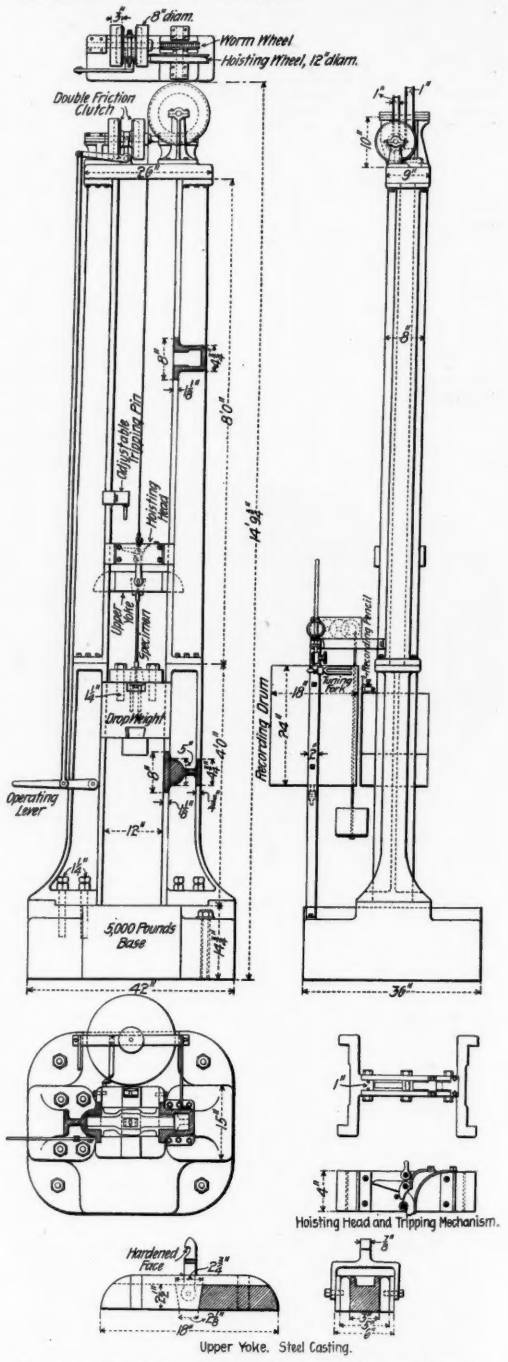


Fig. 3.—Impact Testing Machine—Purdue University.

It is believed that when the wedges are driven tightly, and the apparatus in order, that in the 2,000 ft. lbs. of energy nominally absorbed by the specimen, fully 95 per cent. is chargeable to the specimen. Part of this is, of course, represented by an elastic stretch of the rod; which will result in a recoil, if the rod is not broken. In a few cases the specimen was stretched to a neck by the blow without, however, rupture taking place. In one case the recoil was ¼ in., representing for the 580 lbs. masses lifted, an elastic energy of 12 ft. lbs. In still another case, the recoil was ⅜ in., representing an elastic energy of 18 ft. lbs. Of this latter amount if we reason from the elastic energy in a bar at point of necking in a slow test, there is to be charged to the specimen the amount of 7 ft. lbs. We have then 11 ft. lbs. to charge to the yokes and heads.

During a test of a piece of steel under the action of 12 blows each from a height of one foot, opportunity was given to bring about release while the pencil was in contact with the drum. The curve of the recoil was to the

*Extracts from a paper before the Paris International Congress for the Unification of Tests of Materials.

*This upper head reveals no trace of rupture or cracking after use in breaking 120 test pieces.

eye perfectly smooth, showing a very regular action of the release. In a test of this nature in which a number of blows of equal intensity are used it is interesting to note the hardening effect of the deformation of the specimen. Thus the recoil of the hammer from the first blow was 0.3 in.; from the sixth, 0.5 in.; from the tenth, 0.8 in.

The machine is at present being used in an investigation of the effect of temperature on the resilence of metals under shock. Nickel steel, soft steel, wrought iron and cast-iron are being used for this purpose and the range of temperature at present attained is from — 100 deg. F. to + 400 deg. F. The bars are surrounded with a tube containing the freezing mixture; and broken by a single blow. Difficulty is experienced in bringing about rupture of the bars at the center in experiments at low temperature, even when the wedges and heads of bar are frozen. An unturned bar 12 in. long was frozen with ice and salt for 4 in. at the middle while the ends were left exposed. The bar was broken with one blow. Both ends near the wedges were drawn down to a neck, while the frozen middle center of the length preserved its original diameter and length. Indeed, the elastic limit seemed not to have been exceeded along the frozen length, for the scale was intact and the surface of the bar bright after impact. For this reason the bars may break at the ends. The cause may, however, only partly be due to difference of temperature of the middle of the bar and the ends, for there seems to be a tendency toward localization of deformation of bars at ends even at ordinary temperatures. Shock tests on concrete blocks 6 x 6 x 6 in. are also in progress.

New Icing Plant of the "Burlington Route" at Hannibal, Mo.

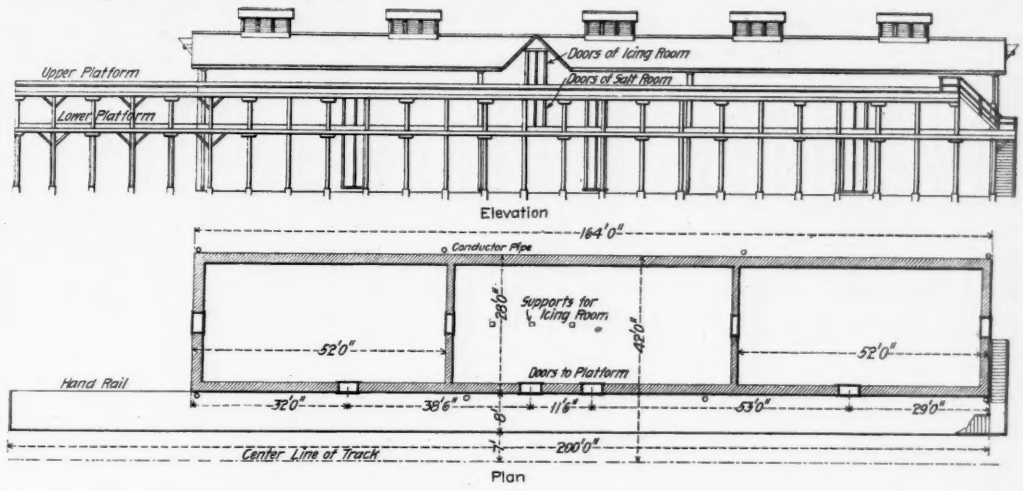
Recently, Mr. Henry Miller, Assistant Superintendent of the "Burlington Route," in a paper before the St. Louis Railway Club, referred to the new icing plant of that road at Haninbal, Mo., which is shown by the accompanying engravings. Extracts from his paper on the preservation of perishable freight were published in our issue of Oct. 5. The chief idea in the design of the new station is to enable cars in transit to be re-iced with as little delay as possible.

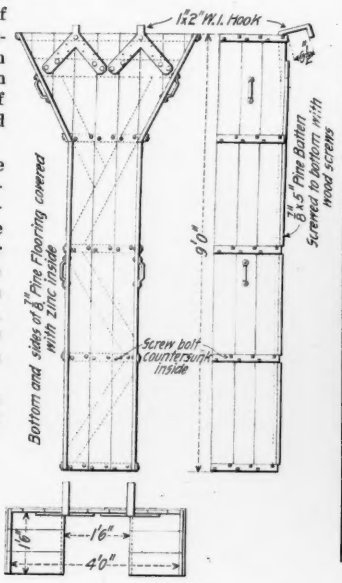
As shown by the plan, the building is divided into three large compartments which, together, have a storage capacity of about 3,000 tons of ice. These separate compartments are provided so that when taking out ice the circulation of air, caused by the doors being open more or less, is confined to a single compartment and the entire ice supply is not exposed. As may be seen the building is supported on piling and the walls are carefully insulated. The building is 164 ft. long and the icing platform is 200 ft. long and 8 ft. wide, making room for icing six cars at a time.

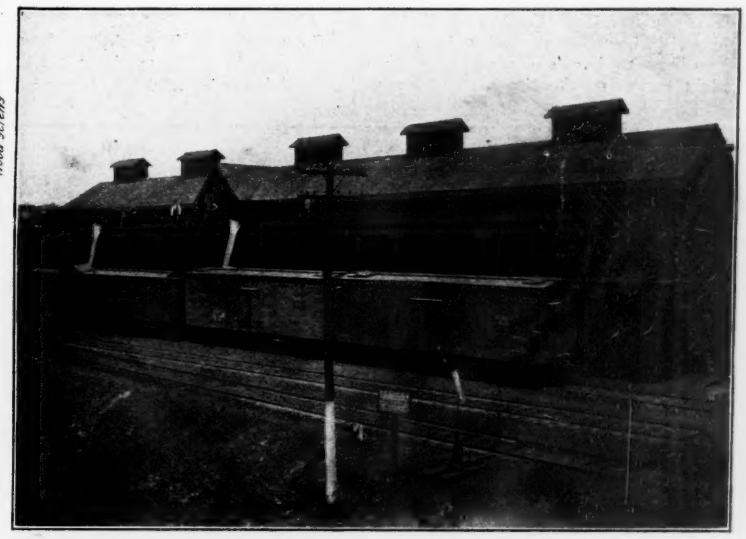
At the middle of the building and on a level with the lower platform is a room, 16 ft. long and half the width of the building, which is used for storing salt. Directly above is a compartment of similar size in which the ice is prepared. This icing room has double doors opening onto the upper platform, and also a single door at the rear through which ice is brought in. Ice is now elevated to the level of this room by a windlass, but it is proposed to instal a hydraulic hoist to facilitate the work. The ice is broken by large wooden mauls and loaded in small dump cars. Six ice cars are used, each holding about 1,200 lbs. of ice. After the small cars are loaded they are kept in the icing room until a train arrives, when they are run out on the upper platform and the contents dumped directly into the ice-boxes of refrigerator cars through chutes. The salt is mixed with the ice by the attendants at the time the ice is spread in the boxes, and these attendants work on the lower platform and car roofs which are about the the same height. It will be noted that the salt room opens onto the lower platform, so that this work can be done very conveniently. In extremely hot weather about 10 per cent. of salt is required for fresh meat shipments.

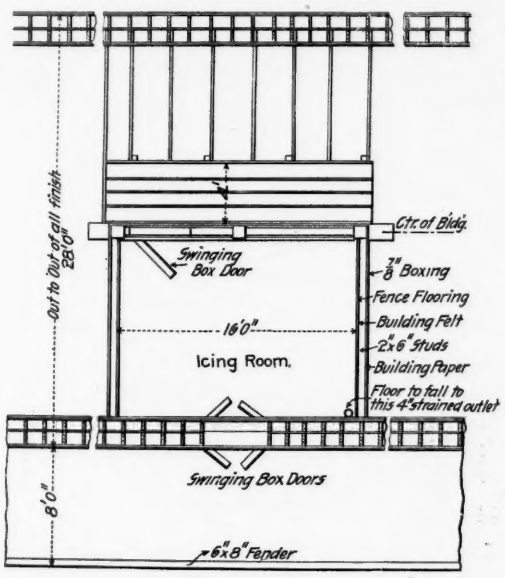
The details of the small ice cars and chutes are shown by the engravings. Being able to work on six cars at a time, they can be iced quickly and economically. The number of men required about the plant varies with the number of cars to be re-iced and this business fluctuates so greatly that there is no regularly organized force, but men are used when needed that are differently employed at other times.

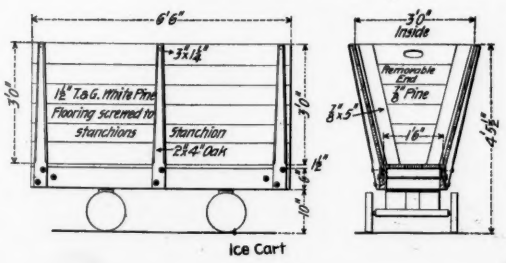
We are indebted to Mr. Miller for drawings and information.

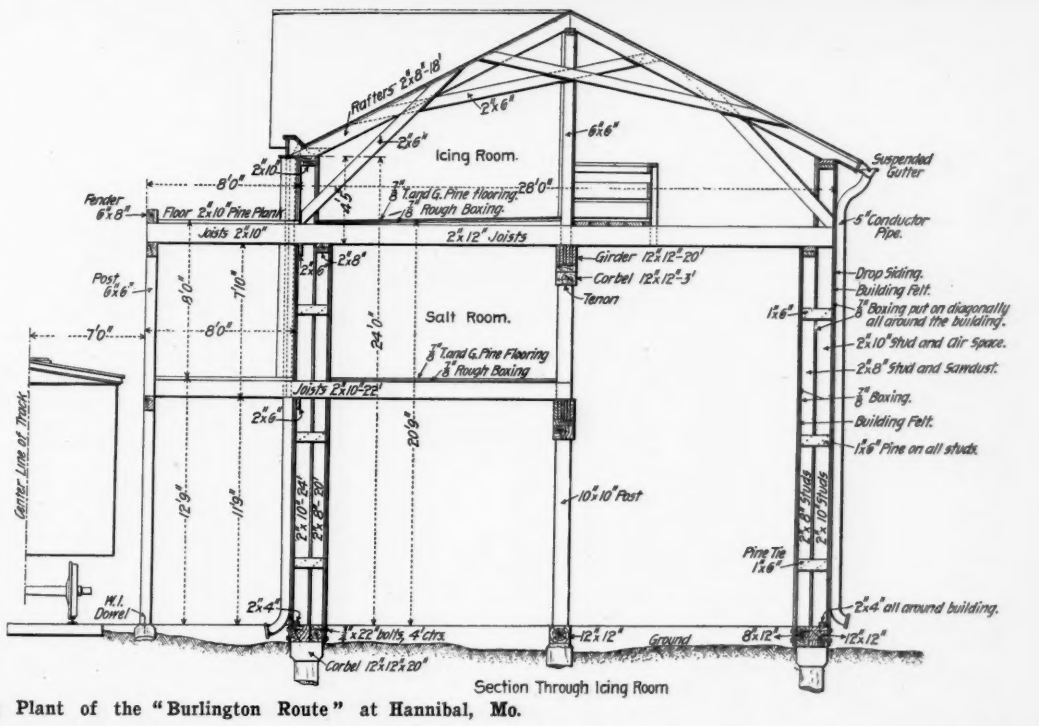












Icing Plant of the "Burlington Route" at Hannibal, Mo.

The M. C. B. Coupler.

At the October meeting of the Pacific Coast Railway Club a topical question was, "Is the M. C. B. vertical plane coupler a success? Has it come to stay?" Concerning this Mr. J. E. Dillen, General Yard Master, Western Division Southern Pacific, said:

I believe that I ought to speak of one or two minor defects in the "Lone Star" which the service has revealed, and nothing else could have made clearer to its inventor, and that is, the opening at the top of the coupler, which, be it ever so small, is sure to admit more or less dirt, as is the case when cars are in the sand or gravel service, and after a certain amount of accumulation, will prevent the proper working of the latch or block inside the head. The Janney does not possess this objection in so marked a degree, and has in fact reduced this opening to the smallest possible extent, in so far as it is confined to the necessary clearance for the easy working of the solid pin in its sleeve, and even this is further minimized by the cap or shoulder which forms the top of the lock pin. The other pattern spoken of, must have

a hole in its top large enough to admit the chain which connects the lifting device with the lock pin, so that it may have perfect freedom of action, and herein lies the objection to the pattern.

My experience thus far with the different types of couplers in use and adopted by the different lines operating in this country, has led me to think very favorably of the type known as the "Trojan." This coupler is entirely free from the objections referred to above, and the additional objection of the lifting device of the two couplers previously spoken of, being on top of the deadwood and very naturally in the way of projecting loads, which so frequently put the lifting device out of action and necessitates the going in between and manipulating the knuckle with the hands.

My experience also shows the necessity of great care and skill in the mechanical work on any and all forms, which even now stand in need of great improvement. I think that the strength of the several parts should be materially increased so far as is possible.

I will further state that the greatest trouble we find with all patent couplers is this, at a very low tide when unloading the freight transfer boats which ply between Oakland and San Francisco, they become uncoupled, and we have to return to the old link and pin to get the cars off of the boats. This causes a great deal of delay and annoyance, as I have known an entire boat load of 16 cars having to be coupled by links and pins before they could be pulled off of the boat. Answering the query, I should say, undoubtedly, yes.

Compressed Air Traction in New York City.

In the *Railroad Gazette* of May 29, 1896, an illustrated description of the Hardie street car motor was published. Minor changes have been made in it since then, but it remains essentially the same in principle, and we have noted at various times progress made with it in city traction. The improved valve gear, illustrated herewith, is one of the points in which material change has been made. The work done by these motors in night service on the North Clark street line in Chicago has also been noted, and it may be recalled that they made a record last winter during the severe blizzard by keeping close to the schedule time while other street traffic was snowbound. Recent developments of this mode of traction in New York City invite a summary of what has been done.

Fig. 1.—Hardie Compressed Air Car—Metropolitan Street Railway, New York.

The Compressed Air Company, 621 Broadway, New York, controlling the Hardie patents, has equipped 20 cars, as shown in Fig. 1, now running on the 28th and 29th street lines of the Metropolitan Street Railway Company, in constant service; east, from west 23rd street ferry, by way of 28th street to 34th street ferry on the East River, and returning by way of 29th street. The distance is 4.86 miles for the round trip and the time is 40 minutes, or an average speed of 7.29 miles an hour, including 36 fixed stops and the usual street delays. The cars are run at intervals of 2½ minutes during busy hours, this interval being varied during the day, as customary. The maximum speed is about 12 miles an hour, but the motors have developed a speed of 31.7 miles an hour under test. The latest traffic estimate available puts the average daily number of passengers carried on this route at 21,000.

The air compressing plant and shops are at 12th avenue and 24th street. The compressors are driven by a 1,000 h. p. Reynolds-Corliss vertical, cross-compound, condensing engine; steam pressure 150 lbs., 27 revolutions per minute for present service; cylinders 32 in. and 68 in. x 60 in.; direct-connected to a four-stage, single-acting Ingersoll-Sergeant air compressor, with the necessary coolers. The diameters of the compressing cylinders are, low pressure, 46 in.; first intermediate, 19 in.; second intermediate, 13.75 in.; and, high pressure or last stage, 6 in., the stroke being that of the engine, 60 in. The plant is designed to compress 3,750 cubic ft. of free air to 2,500 lbs. per sq. inch, per minute, at a maximum engine speed of 75 r. p. m. Four Babcock & Wilcox boilers, of 250 boiler h. p. each, supply steam for the entire plant, including shops and recharging of re-heaters on the cars.

The compressing plant has now air storage for 1,050 cubic feet, this being subject to ready increase by adding to the number of steel "bottles" that compose the plant reservoir. With present track facilities two cars can be charged at once with air, and with water for re-heating, the complete operation requiring about two minutes. The cars have each 55 cubic ft. of air storage, air being carried at 2,500 lbs. initial pressure in two nests of seven bottles each under the car, and two long bottles within the car, placed longitudinally under the seats. The air is reduced to 150 lbs. pressure per sq. inch before entering the re-heater and passing thence to the cylinders. The reservoirs within the car are concealed and take up no passenger space. Pintsch gas reservoirs are also under the seats and concealed. Cars run one or two round trips without recharging, dependent on the weight of traffic, weather conditions, and skill and judgment of the motorman. On each platform are placed the operating devices, consisting of reversing lever, throttle lever, air-brake lever and the valve for shutting off air storage. A hand brake is also supplied for emergency. The shops are in the same building with the compressing plant and have two long pits and a machine department, affording all necessary facilities for maintenance.

The cars are 32 ft. long over all, seating 30 persons. The car body is 22 ft. long, and free room on platforms is four feet each. The weight of the motor truck is 11,000 lbs. and the total weight of car in working order 19,000 lbs. The construction of the truck and motor, and also the separate spring suspension of the car body and truck frames, is apparent from Fig. 2. It may be noted that the car body is carried by elliptic springs that rest directly on the truck frame and are pivoted by special fulcrum to the car body; also that the driving wheels, 26 in. diameter, are journaled in regular locomotive style and have the usual driving box spring suspension. The effect of this arrangement is excellent and cars run very steadily at speed and during stops and acceleration.

The relative positions of air reservoirs and re-heater are also shown in Fig. 2, and in Fig. 5 the re-heater is shown in detail. When the air leaves the high pressure reservoirs its passes through a pipe leading to the controller "stands" on the platforms where it is controlled by what is called the platform valve. From this point it passes to the reducing valve, which establishes the initial cylinder pressure of 150 lbs. previously referred to, then from the reducing valve into the re-heater before being received in the cylinders. The pipe that conducts the air into the heater is connected with a pipe inside of and at the bottom of the heater, as shown in Fig. 5. The latter pipe is closed at the ends and its surface is

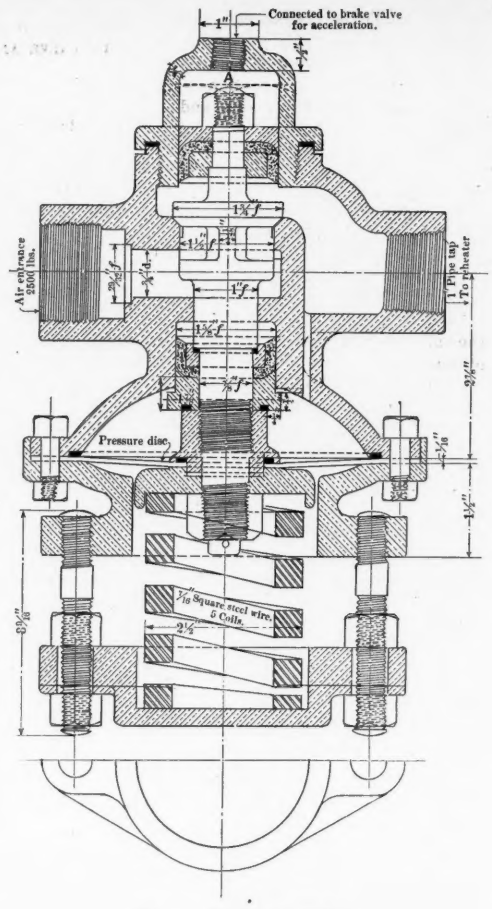


Fig. 6.—Reducing Valve.

perforated with small holes, the object being to distribute the air as widely as possible through the heated water. From the re-heater air passes to the throttle valve by way of pipe "T," Fig. 5, and thus into the cylinders. At the side of the heater and below the reducing valve, which is shown in Fig. 6, there is a small tank, about three feet long and six inches in diameter, that is called a drip pocket. It is to prevent water reaching the reducing valve in case it should back up from the heater.

It is apparent from Fig. 6 that the reducing valve is a diaphragm valve, specially constructed to deal with high pressure, and that, in addition to the ordinary action of such valves, a supplementary action is brought about by reducing the air pressure that is normally kept above the valve head in chamber A. In ordinary action this valve graduates air to 150 lbs. When it is desired to quickly accelerate under heavy load, a movement of the brake valve handle to a given position discharges the air from chamber A and thus increasing the value of the coil spring beneath the diaphragm, opens the reducing valve in greater measure and temporarily increases the working pressure to 200 lbs. per sq. inch, while it is desirable to use that pressure in the cylinders. The initial temperature of the fresh-charged water in the

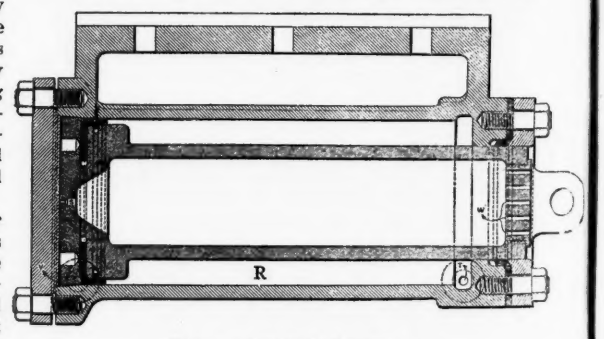


Fig. 7.—Brake Cylinder.

re-heater is about 300 degrees F. In this connection it may be said that to test the value of re-heating a motor with a storage of 35 cubic ft. of cold air was run until exhausted at the end of eight miles. The motor was afterward run 15 miles with an equal air storage, by re-heating the air to the degree mentioned before passing it into the cylinders.

In Fig. 3 the latest development of the Hardie improved cut off valve gear is shown in side and end elevation. It may be noted that a supplementary cut off arrangement is used, and that the motion of the cut off valve is obtained through a system of floating levers moved by the crosshead and the link jointly. The motion is primarily a Stephenson link gear to operate the main valve. On the outside of the link there is a double armed rocker a. To the

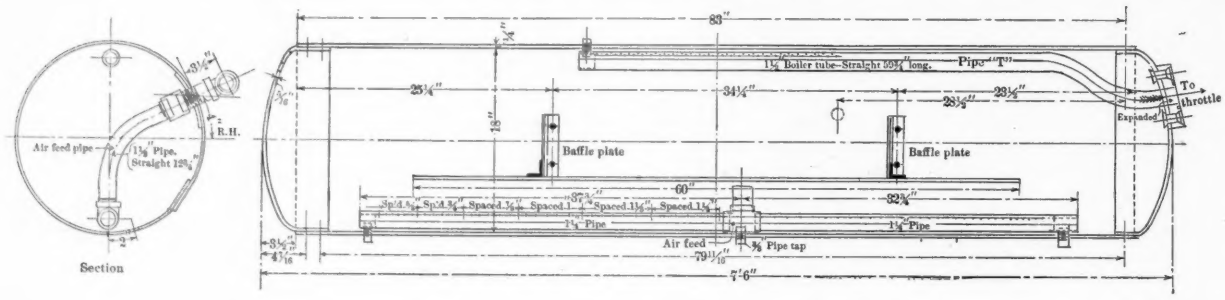


Fig. 5.—Re-Heater—Hardie Air Motor.

end of the lower arm is attached a floating lever f. The upper end of the lever f receives a reduced motion contrary to the motion of the piston, through the lever g and bar l, g being pivoted to the frame at point p. The lower end of lever f moves in a direction opposite to that of the main valve. The lever f is attached to the cut off valve rod at m. With this arrangement and the crossing of the eccentric blades the range of cut offs for main valve and cut off valve, at various piston travels, shown in the table accompanying Fig. 4, are obtained.

In Fig. 7 the air-brake cylinder is illustrated. As apparent from the longitudinal section there shown the brake piston rod is hollow, and thus forms a cylinder within the brake cylinder. In the illustration the piston is shown in the set position and the motorman's brake valve would be in service application. Braking force is applied by admitting air to the annular space marked R. When release is made the air passes from the point T through the point V, and pressure is thus exerted upon the greater area of the total diameter of the piston head. The difference in pressure area will therefore restore the piston to the release position and the air, thus applied in releasing, bleeds through the opening S and out of the hollow piston through numerous ports, W, to atmosphere, the bleeding action being so free as to be practically noiseless.

Bearing upon the cost of operating a street car system by compressed air the following figures are significant. In the report of the Metropolitan Street Railway Company, New York, for the year ending June 30, 1900, a comparison of the relative cost of operating cable, electric and horse railroads is given. It is there stated that the total operating expenses for 9,812,031 horse-car miles averaged 18.98 cents per car mile; that 10,610,091 cable-car miles averaged 17.76 cents per car mile; and that 24,968,196 electric car miles averaged 13.16 cents per car mile. These figures were made to include all expenses; maintenance of way; maintenance of equipment; power and all repairs; transportation of men; and salaries of officers and clerks under the head of general expenses. They represent a total cost per car mile for operation complete as nearly as it can be assembled. The compressed air cars on the 28th and 29th street lines in New York have been running about two months, and in that time have run considerably less than 100,000 miles, the maximum number of cars being 20, and this number but recently being employed. A careful estimate, made to conform as closely as possible to the scope of the report previously quoted, establishes 17.42 cents per car mile for the compressed air operation to date. When it is considered that these 20 cars are being operated from a central plant, which has a capacity for probably 100 cars of the same individual power as that now used, the further estimate made by the Compressed Air Company showing that this cost per car mile can probably be reduced to 13.57 cents, is not unreasonable. It is interesting to note in this connection that, with all the inconvenience that attends the operation of a comparatively new plant, with men new to the work, the repairs have thus far been held down to two cents per car mile and the cost of operating the charging station and power house to 6.31 cents per car mile.

The great advantage of having independent motors is generally recognized. The impracticability of using steam as a motive force for street cars is likewise conceded. The choice, therefore, narrows, in the present state

RESULTS OF DISTRIBUTION OBTAINED BY HARDIE VALVE GEAR FOR THREE POSITIONS OF LINK, WITH 3-16 IN. INSIDE AND OUTSIDE LAP OF MAIN VALVE AND 11-16 IN. NEGATIVE LAP OF CUT-OFF VALVE. ADMISSION PORTS 2½ IN. X ⅝ INCHES. CYLINDER, 6½ IN. X 12 INCHES.

First Position. Main Valve (Full) Travel 2 Ins.; Cut Off Valve Travel, 2 Ins.							Second Position. Main Valve Travel, 1⅜ Ins.; Cut Off Valve Travel, 1¼ Ins.						Third Position. Main Valve Travel, 1 In.; Cut Off Valve Travel, 1¼ Ins.					
Crank Angle.	Cut Off Valve Opening.		Main Valve Opening.		Piston Travel.		Crank Angle.	Cut Off Valve Opening.		Main Valve Opening.		Piston Travel.		Crank Angle.	Cut Off Valve Opening.		Main Valve Opening.		Piston Travel.	
	Front.	Back.	Front.	Back.	Fr'nt	Back		Front.	Back.	Front.	Back.	Fr'nt	Back		Front.	Back	Front.	Back.	Fr'nt	Back
	Ins.	Ins.	Ins.	Ins.				Ins.	Ins.	Ins.	Ins.				Ins.	Ins.	Ins.	Ins.		
0°	1⅛	7/16	7/16	7/16	.0	.0	0°	1	1 1/16	5/16	5/16	.0	.0	0°	1 1/16	1 1/8	1/8	7/16	.0	.0
10°	31/32	13/16	3/8	3/8	.11	.08	10°	13/16	15/16	1/4	5/16	.11	.08	10°	15/16	1	3/16	3/16	.11	.08
20°	11/16	5/8	1/2	1/2	.42	.31	20°	9/16	11/16	3/16	1/4	.42	.31	20°	11/16	11/16	1/4	1/4	.42	.31
30°	0	0	5/8	5/8	.94	.67	30°	1/4	7/16	1/8	3/16	.94	.67	30°	7/16	7/16	5/16	5/16	.34	.67
40°	— 1/4	— 1/4	11/16	11/16	1.61	1.20	40°	1/8	5/16	1/16	1/8	1.61	1.20	40°	1/4	5/16	3/8	3/8	1.61	1.20
50°	— 1/2	— 1/2	3/4	3/4	2.46	1.83	*50°	— 1/8	— 1/16	1/16	1/16	2.46	1.83	50°	1/16	1/16	7/16	7/16	2.46	1.83
60°	— 11/16	— 11/16	13/16	13/16	3.39	2.62	60°	— 1/4	— 1/4	1/16	1/16	3.39	2.62	60°	1/4	1/16	1/2	1/2	3.39	2.62
70°	— 7/8	— 7/8	15/16	15/16	4.44	3.48	70°	— 1/16	— 1/16	1/16	1/16	4.44	3.48	70°	5/16	1/16	9/16	9/16	4.44	3.48
80°	— 1 1/32	— 1 1/16	15/16	15/16	5.47	4.45	80°	0	0	1/16	1/16	5.47	4.45	80°	0	0	9/16	9/16	5.47	4.45
90°	— 1 1/32	— 1 1/16	15/16	15/16	6.53	5.48	90°	— 1/16	— 1/16	1/16	1/16	5.47	4.45	90°	— 1/16	— 1/16	9/16	9/16	6.53	5.48
100°	— 1 1/32	— 1 1/16	15/16	15/16	7.55	6.54	100°	— 1/16	— 1/16	1/16	1/16	7.55	6.54	100°	— 1/16	— 1/16	9/16	9/16	7.55	6.54
110°	— 1 1/32	— 1 1/16	15/16	15/16	8.54	7.56	110°	— 1/16	— 1/16	1/16	1/16	8.54	7.56	110°	— 1/16	— 1/16	9/16	9/16	8.54	7.56
120°	— 1/8	— 1/8	3/4	3/4	9.39	8.62	120°	— 1/16	— 1/16	1/16	1/16	9.39	8.62	120°	— 1/16	— 1/16	9/16	9/16	9.39	8.62
130°	— 1/16	— 1/16	11/16	11/16	10.17	9.54	130°	— 1/16	— 1/16	1/16	1/16	10.17	9.54	130°	— 1/16	— 1/16	9/16	9/16	10.17	9.54
140°	— 1/16	— 1/16	11/16	11/16	10.81	10.39	140°	— 1/16	— 1/16	1/16	1/16	10.81	10.39	140°	— 1/16	0	9/16	9/16	10.81	10.39
150°	— 1/16	— 1/16	11/16	11/16	11.33	11.06	150°	— 1/16	— 1/16	1/16	1/16	11.33	11.06	150°	0	1/16	9/16	9/16	11.33	11.06
160°	— 1/16	— 1/16	11/16	11/16	11.70	11.58	160°	— 1/16	— 1/16	1/16	1/16	11.70	11.58	160°	1/16	1/16	9/16	9/16	11.70	11.58
170°	1/16	1/16	11/16	11/16	11.93	11.89	170°	1/16	1/16	1/16	1/16	11.93	11.89	170°	1/16	1/16	9/16	9/16	11.93	11.89
180°	1/16	1/16	11/16	11/16	12.00	12.00	180°	1/16	1/16	1/16	1/16	12.00	12.00	180°	1/16	1/16	9/16	9/16	12.00	12.00

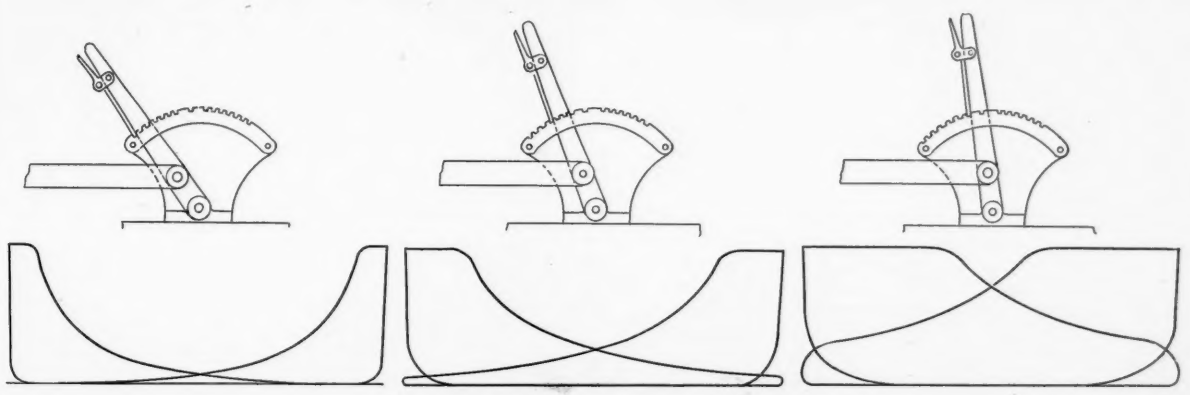


Fig. 4.—Hardie Valve Gear—Three Positions of Lever.

Main cut off and compression crank angle 148°.
Lead angle of crank, front 12°, back 12°.
Point of cut off not including clearance 14.81 of stroke.
Point of cut off including clearance 9.54 of stroke.
Greatest port opening 7/16".
Relative travel of main and cut off valves 3⅝".

*Cut off at 47° average piston travel 1.91".
Main cut off and compression crank angle 138°.
Lead angle of crank, front 13°, back 13°.
Point of cut off not including clearance 6.39 of stroke.
Point of cut off including clearance 5.19 of stroke.
Greatest port opening 3/8".
Relative travel of main and cut off valves 2 11/16".

Main cut off and compression crank angle 117°.
Lead angle of crank, front 18°, back 18°.
Point of cut off not including clearance 2.42 of stroke.
Point of cut off including clearance 2.39 of stroke.
Greatest port opening 5/32".
Relative travel of main and cut off valves 1⅝".

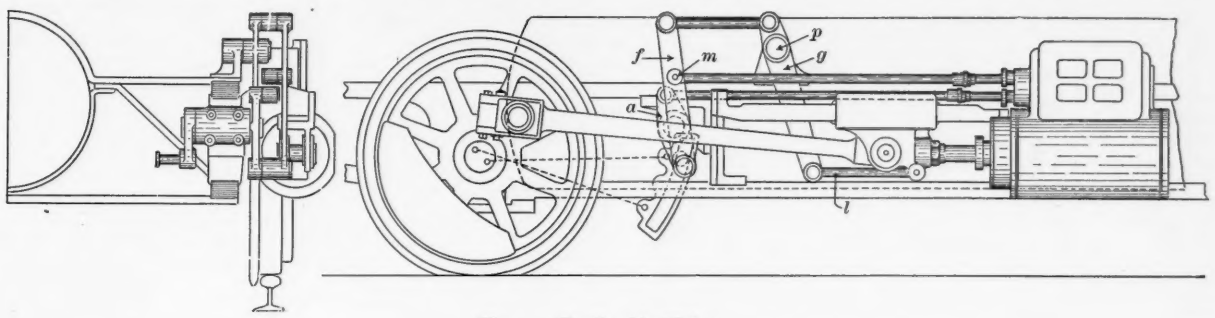


Fig. 3.—Hardie Air Motor.
Elevations Showing Valve Gear.

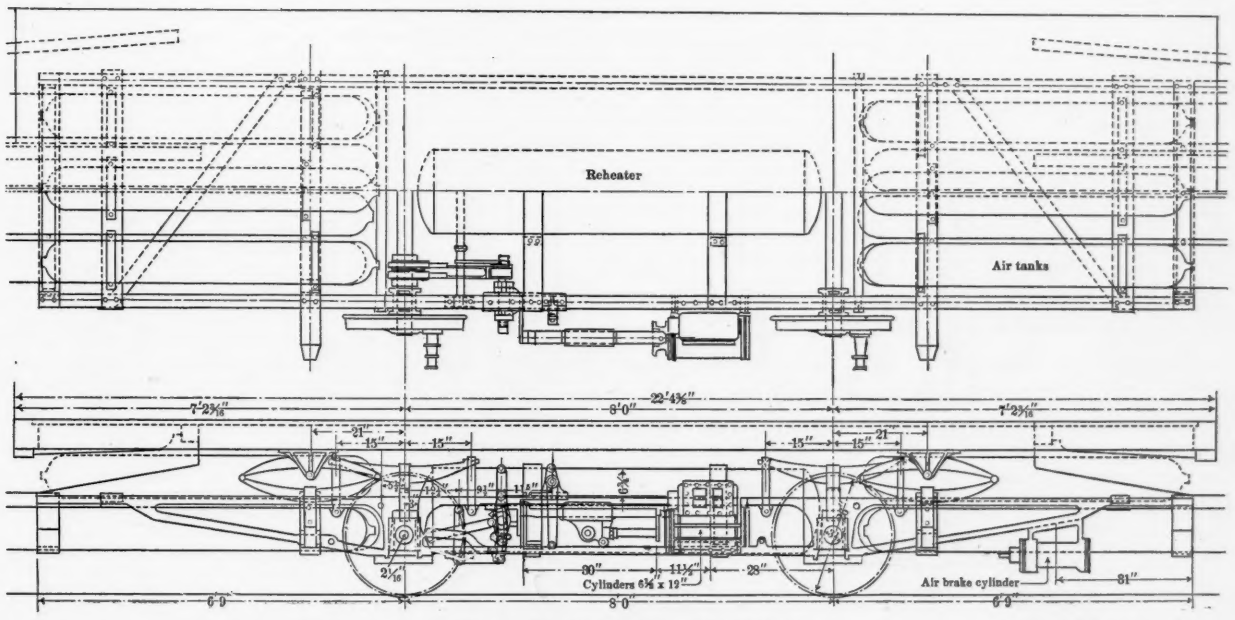


Fig. 2.—Hardie Compressed Air Motor.
Plan and Elevation.

of the art, to that of very heavy and expensive electric storage battery cars or compressed air motors, when independent units are considered. It is not inconceivable or even unlikely that there are in New York, and in many other cities of consequence, cross-town streets where the interest on the first cost of placing an underground electric or a cable system, in the maze of pipes and conduit there holding a prior claim, would continuously exceed the actual cost of operating a compressed air system of traction, when large plant units are considered.

It is a noticeable feature of the operation of the cars now running on 28th street and 29th street that the noise of exhaust that was objectionable in the working of the Hoadley-Knight motors is practically eliminated. The cars, both in acceleration under heavy load and when running at speed, are probably the least noisy of all cars operating on street railroads, unless the cable car be excepted. At first thought it would seem that in exhausting air from an initial cylinder pressure of 150 lbs. per square inch, there would be a pronounced sound from the cylinders, as in the case of the locomotive. It is apparent, however, that in dealing with a permanent gas such as air, where expansion may be carried to the limit without loss by condensation, and where the exhaust opening is practically limitless in area because no fire is to be forced, the noise of exhaust may be reduced in proportion to the expansion of air and freedom of exhaust, and becomes, as in this instance, practically nothing.

Can the American Shipbuilder Compete With the British and German Shipbuilders?*

BY GEO. W. DICKIE, ESQ., MEMBER OF COUNCIL.

I am presenting this paper to the Society in response to a request received from the Secretary before starting out on a trip to Great Britain and Europe, the object of which was partly to note what advantages the shipbuilders there had over ourselves, either in skill, labor, or material, that would enable them to produce great ocean freight and passenger carriers at less cost, or with greater certainty as to results, than ourselves. This paper is being written on board one of the latest examples of the shipbuilders' art in that combination of great cargo capacity and a moderate amount of very comfortable passenger accommodation, combined with a speed that was considered fast not many years ago. The steamship "Saxonia," on which I am writing this paper, is the embodiment of a higher type of skill in naval architecture than those vessels wherein everything is made subordinate to speed. This type of ship will become the most important in the future extension of American shipping. Here is a vessel that carries 9,000 tons of freight at 15½ knots on a coal consumption of 145 tons a day, or 1,200 tons of fuel used to carry 9,000 tons of cargo across the Atlantic, and at a speed that secures a large passenger patronage. The secret of obtaining this result is, first, the great increase in the size of ship, and, second, fitting engines of just the size required for the speed. The old idea of having a large surplus of engine and boiler power that the owner can never afford to run at its full capacity is a thing of the past, and ships are now designed with just sufficient power to meet the conditions as required by the trade in which they are to engage. Increased efficiency of engines and boilers has also helped in this astonishing result. . . .

In regard to skill, I have always found it difficult to make any just comparison, the term meaning different things to different people. Skill in design must in merchant work have the commercial element as a prominent factor, and must embrace the financial interests of the shipbuilder, the ship owner, and the underwriter. Certain societies representing all the interests involved hedge the designer about with rules that give him but a very narrow field in which to exercise his skill as a naval architect. Yet, narrow as this field is, the progressive shipbuilders of Europe are continually pushing out the barriers. . . . Hampered on every side as the naval architect is, by rules and traditions, his skill has been ever on the alert for the smallest opportunity to push out still farther the barriers set up against him. . . I have found that the skill of the experts at Lloyd's, and the careful study of every proposition made to them, not only protects all parties, but insures a steady forward movement, consistent with the proper protection of all the interests involved. I believe, however, that an American register of shipping that would be accepted by the ship owner and by underwriters the world over, would be a great help to the American shipbuilder, as it would no doubt lend itself more readily to the tendencies of American design. . . .

Now can we in America do better than this? We are very likely to do a little different, as much different probably as the limitations referred to will allow, and these differences will, I think, take the form of a closer adaptation of the material used to its place and function in the complete design. In this the steel manufacturer will likely take a share. As he becomes better acquainted with the special needs of ship construction, we will find him ready to undertake new sections better adapted to take the strains and stresses of ship structure, and reducing built up work to a minimum. We are on this point now abreast of the British builder, and, in methods of handling, ahead of most of them. In skill I think the American naval architect is quite abreast of his British cousin. . . . I find, also, especially among the younger naval architects in Britain, an opinion they are ready enough to express, that the United States is to be in the near future a rich field for the practice of their profession. . . .

Granting, therefore, that there is nothing lacking in skill on the part of our designers, how are we in regard to the second factor in the problem of competition, that of the cost of labor? This is the one factor that presents the greatest difficulty in dealing with the the problem of relative cost as between the shipyards of Great Britain and those of America. We work under different conditions in regard to a large portion of the work. The whole steel work of a ship may be said to be done under the piece-work system in Britain, the price per unit being fixed for certain shipbuilding districts between the shipbuilders and the unions representing the men. This method has its advantages, as it simplifies the estimating—a certain known portion of the work having a certain fixed value. While a considerable portion of the work with us is done on some piece work system, every yard appears to have its own way of fixing prices with the men. In the British yards, as with us, while practically all the steel work is done under some kind of piece system, yet on inquiry it appears that it is with them very much as it is with us; the number of men on wages on the very work supposed to be done by piece is greater than that of the piece-workers, and skill in management is directed to the reduction of the number of men on wages as compared to the number on piece work.

I find that on an average the steel work of construction cost in the British yards from £3 17s to £4 per ton of material worked. This I think we can about equal in labor cost here. But when it comes to fitting out, including carpenter and joiner work, painting, and general finish, where piece work does not cut any figure, the cost, I think, is directly as the wages paid, and where we are paying 50 per cent. more wages, the cost of labor that is reckoned in wages will be 50 per cent. more here than it is in the British yard. And if half the labor cost for any given ship built in a British yard is paid in wages—and this is very nearly correct—and that half costs 50 per cent. less than the corresponding part in our yards, our total labor cost will be 25 per cent. greater than theirs. This is very nearly correct, as tested by comparisons. . . .

As to what we may be able to do in regard to equalizing the cost of labor as between our yards and those of Great Britain, I do not think that it will be brought about by any attempt to equalize the rate of wages paid throughout the shipbuilding world, but I have hopes that some of our rising shipbuilders may be able to devise some method whereby every part of a ship will have a labor value fixed for it that will not exceed what such a piece of labor costs elsewhere, and that whoever, by his labor, contributes to the production of that piece shall receive as recompense his portion, that is, the percentage that his labor represents in the total labor required to complete the part on which he worked. Something of this kind must be the foundation on which any true settlement of labor values must rest, and as it is done now with eminently satisfactory results in some of the most prosperous machine manufacturing establishments in England, it only needs the right kind of skill, honestly applied, to make it work in shipbuilding and engineering establishments in this country. I am so impressed with this, to me the only just way of recompensing labor, that were I 20 years younger I should take it up as a life work.

I find that the marine engine and its boilers cost less in proportion to the hulls than they do with us. . . . In small tools I think we are better equipped than the engine works attached to the large shipyards there, but in heavy tools we are not better off than they are.

Some prominent engine builders in this country seem to be able to compete with engine builders in Great Britain, sending their engines to the very centers of engine building in that country, and, so far as we know, with profit to themselves. At least they continue doing it, which would indicate that it is profitable. If this can be done with land engines it can also be done with marine engines, but not on present methods. We must be content without the professional luxury of introducing some engineering novelty with every ship we engine. . . .

In a large and prosperous engine works that I visited in England, building a special type of engine, but in all sizes from 10 to 3,000 h. p., I found that the term erection was not used. Every part of their engines is made to gage, and when finished from the tools is sent to an expert examiner at a large surface table, with accurate measuring instruments, whose business it is to determine if every operation performed by the tools on that piece has been accurately done; that every hole has been bored properly; that every face is in its proper plane. He signs the workman's card that did the work if it has been done correctly; if not, the work is returned to him for correction, or rejected if it cannot be corrected. Every piece of work has a fixed labor value. Every man gets his regular wages. If the work he produces exceeds in labor value the wages he is credited with 50 per cent. of the difference. If the labor value of his work is continually less than the wages paid him he cannot continue to work in that establishment. The pieces thus produced that go to make an engine when brought together are not erected as we do, fitting each piece to its place by file or chisel, as may be, owing to defective tooling; but they are placed in stock ready to be assembled in a few hours on receipt of an order for an engine of the size they represent. A system to insure correct tooling on every piece entering into the construction of our marine engines would, in my opinion, reduce the cost of erection by one-half. Some such system, and making every man a partner, so far as the result of his own labor is concerned, would place us in marine engineering where we are now in the production of land engines. . . .

In regard to the cost of material: I am afraid that this part of my subject is beyond my ability to in any satisfactory way compare our conditions with those of the British or European shipbuilder. The most important material affecting the cost of shipbuilding is steel, and the tremendous fluctuations that at times take place in the price of that material in this country, is the most serious question we have to contend with in trying to predict anything in regard to the future of shipbuilding in this country. The tariff on steel plates and shapes makes it possible for us to find the British shipbuilder working into his ships American steel from Pittsburgh at a less cost to him than the English material, and at less cost than is charged the American shipbuilder for the same material in Pittsburgh. I saw in a yard on the east coast of Scotland steel being worked into a vessel that was delivered in the yard at Pittsburgh at less than £7 2s 6d per long ton. If the American steel manufacturer can meet the British steel manufacturer on equal terms in the British shipyards, somehow it seems as if it might be possible for the American shipbuilder to get his steel material as cheap as the British shipbuilder gets his. This is all that I possibly can advance on this part of my subject. As the duty on steel of this character is not a protective measure, and cannot possibly produce revenue, it should not be maintained to render wild fluctuations in price possible. I may be wrong, however, as to the cause of the immense variations in the price of steel here, but I think I am right in saying that such conditions relative to the most important material he uses are a great obstacle to the progress of the shipbuilder in this country.

Engine and other forgings cost more with us than they do in Britain and Europe. In ordinary forgings of steel this difference is from 30 to 50 per cent., and in high-grade forgings, such as required by our Navy Department specifications, there is no comparison. The usual extra charge for nickel steel forgings in Britain is £4 per ton extra for each 1 per cent. of nickel in the steel. I did not find nickel steel forgings being used at all in merchant work.

On the whole, I think the British builder has an advantage over the American builder in the cost of material. This applies even to the wood used. As near as I can judge at the present time there is 10 per cent. in cost of material in favor of the British shipbuilder as compared with the cost of material in American yards.

From the foregoing, if the statements I have made are correct, we are not yet in a position to compete with the shipbuilders of Britain or Europe, Europe meaning Germany only I think, in this connection, the difference being not less than 15 per cent. on the finished ship.

*Read at the eighth general meeting of the Society of Naval Architects and Marine Engineers, held in New York, Nov. 15 and 16, 1900.

Meeting of the Roadmasters' Association.

The eighteenth annual meeting of the Roadmasters' Association of America was held in Blanchard Hall, Los Angeles, Cal., Nov. 13 and 14, the presiding officer being Mr. S. B. Rice, of the Richmond, Fredericksburg & Potomac. After a short address by President Rice, routine business was taken up. The Secretary's report showed a membership of 500, and 15 new members were elected. The Treasurer's report showed $691.71 on hand with all bills paid. The annual dues were raised from one to two dollars for active members. The following are extracts from the reports and discussion:

Use of Tie Plugs in Hard and Soft Wood.—Committee: T. Hickey, Michigan Central; G. M. Brown, Flint & Pere Marquette; T. S. Cafferty, Atchison, Topeka & Santa Fe; J. W. Meredith, Chesapeake & Ohio; H. Ferguson, Grand Trunk, and P. W. McKeon, Delaware, Lackawanna & Western.

The committee has made several tests under the different conditions with hard and soft wood ties with the different kinds of track spikes having pointed many spikes in different ways to better determine the kind that would less bunch or disturb the fiber of the different kinds of wood. The pressure required to withdraw the spike from ties of different kinds of timber in which some had been driven in a new place while others were driven through the tie plugs was noted. Every spike hole left unplugged fills with water after the first rain, and remains there to soften and rot the tie. Where the spike is withdrawn for any purpose the hole made by the first entry of the spike should be plugged and the spike re-driven in the same place when practical to do so. A spike driven in the tie plug, more particularly in soft wood ties, holds with more than double the adhesive force with which it held when first driven. The advantage of driving the spike into the tie plug results from the fact that when a spike is driven into a tie it must displace and carry down with it a sufficient quantity of fiber to allow the body of the spike be partly unsupported, whereas when driven into the plug it enters lengthwise of the grain of the plug, and so carries down no fiber, but simply compresses the fiber of the

plug against the walls of the spike hole and thus the adhesion is greater than the original. The experience of the committee has demonstrated that the best kind of timber from which to make tie plugs is second growth elm, white oak and ash, in the order in which they are mentioned. Cedar and pine are totally unfit for tie plugs, the timber being too weak and brittle to stand the impact of the blows necessary to drive home; they will break off when only partly driven. Elm is preferred to oak, because when pressure is applied to elm it develops a rough surface, whereas where the same forces are applied to oak it develops a smooth, slippery surface, making the adhesive force greater than oak. This has been demonstrated by actual tests made for the purpose, and further oak is heavier and more costly, both in regard to material and cost of transportation; ash is but very little different from oak as far as its qualities are concerned.

In discussing this report D. Foley, of the Michigan Central, concurred in the report, as it described his experience exactly. P. H. McFadden, of the Pere Marquette, said that his experience in driving a spike in a tie plug had not been satisfactory, because if the spike is again withdrawn the plug will come with it. He advised spiking opposite the plug. J. E. McNeil, of the Southern California, said that in his opinion tie plugs not only strengthen the tie, but prolong its life.

Should Switch Points be Reinforced?—A paper on this subject by H. W. Church, of the Lake Shore & Michigan Southern, was read, in which he argued that all split switches should be reinforced; should be adjustable; should have not less than two head rods; that they should be adjustable from both points, and that the point should be ¼ in. higher than the stock rail. All the arguments of the paper were indorsed except the last one. The majority present were in favor of making the switch point level with the stock rail. F. J. Allen, of the Chicago, Burlington & Quincy, favored the use of more than one head rod. J. W. Fawcett, of the Erie, favored rigid switches in preference to adjustable ones. In this connection a letter from Pettibone, Mulliken & Co. on the subject of reinforced switches was read. Extracts from the letter follow:

Should Points Be Reinforced?—From our experience, splint switch points for main line service should be reinforced; or, rather, should be supported and strengthened for the reason that for nearly 7 ft., from the point, practically one-half of the rail is cut away. The riveting or bolting of iron or steel straps to the switch point, ¼, ⅜ or even ½ in. thick, does not reinforce the point, or strengthen it; and when such straps are used, the term "re-inforced" is misapplied. The only service that these straps can possibly perform is, in the event of the breakage of the point, to hold the broken ends together for a short time. Of course, such straps only perform this service where they are applied; and if, as in many cases, they are applied 6 or 7 ft. from the end, they do not extend this protection to the balance of the point.

It is fair to consider whether such straps are really needed. Most switches are put in on straight track, and if the point is properly planed, and maintained in its normal position on the base of the stock rail, the weight of the passing load is sustained by the main rail until it passes beyond the planing. It might be claimed that as the switch point is not spiked down back of the planing, something should be used to keep it from moving. This is true only of switches on curves, and when so used stop-blocks will prevent movement of the point rails.

The bolts or rivets used to fasten straps to the points simply increase the danger of breakage. The straps largely increase the expense of split switches, and when the points are worn out the straps are usually scrapped with them, notwithstanding the fact that many roads use bolts, with the intention of removing the straps, and putting them into service again. Bolts rattle and require attention to keep tight. It appears to us that straps are in no sense a reinforcement of the points. A proper support for the point should serve to maintain it in its normal position, and such support we believe can be obtained only when applied in such manner as to really stiffen and brace the point. An example of such a construction was shown by a blue print of this company's "Channel" switch.

Should Points Be Higher Than the Stock Rails?—We are making most of our points higher than the stock rails, but from the fact that the point has the weakest rails, we are inclined to the belief that it would be better protected, both as regards wear and breakage, to make the planed portion of the point of the same height as the stock rail, of course with the usual taper to lower it below the stock rail at the extreme point. And we think that in a short time railroads will require that their points be planed in this way, for the reason that loads and speed are increasing. When the tires of wheels are new and the points are raised above the stock rail, the point rail carries the load, and we do not see why the weakest member should do this. For a short distance back of the planing, the point is of necessity a little higher than the main rail; this does no harm, as this portion of the point rail is nearly full section, and able to carry the load, besides this slight rise has the advantage of easing the double flanges of wheels from the point on to the main rail, and from the main rail on to the point. The arguments in favor of planing the points so they will be the same height as the main rail, are that when the wheels are new, the stock rail bears the greater part of the load, as it should, and when the wheels become old and worn, and have double flanges, the stock rail takes all of the wear, and absolutely protects the points at their weakest section.

Should Points Be Adjustable?—Anyone who will examine switches on any road where rigid rods are used, will discover nut locks and washers and wires, between the necks of the rails and the clips, for the purpose of adjusting the points. All such devices rattle, are impractical and dangerous. The fact that such devices are in common everyday use, and seen everywhere, indicates clearly that some form of adjustment should be used. We make 100 switches with adjustable points to five without.

An adjustable tie bar enables trackmen when putting in the switch, to adjust the point rail. This is necessary, owing to the fact that there is variation in rail sections. It is also a well-known fact that split switches made with rigid tie bars, and made correctly, when laid in the track to exact gage and fitting properly, if taken up and put into another part of the track, cannot be made to fit. This should not be true theoretically, but practically it is, being due to slight differences in the rails, ties and ballast and little local conditions which are not exactly the same in any two places on the road. Points with good adjusting devices can always be kept in position and to exact gage, and be made to take up all wear, including wear on connecting rod and switch stand crank.

Slide Plates.—For more than ten years we have been urging our customers to use gage plates in place of slide plates. When this is done slots are planed out at the ends of each plate, for the stock rails, and in this way the plates serve to maintain these rails to gage. The gage plates form the only slides that are necessary, for the points, and the points will move easily on them. With these gage plates, the switch points are always supported on the stock rail, and if they are examined when in the track, it will be found that this statement is correct, the base of the stock rail showing where the point rails have rested. The main rails and the gage plates prevent the point rails resting on the ties. We see no good reason why from twelve to twenty pieces should be used to accomplish a certain result, when two pieces will do the same, and better work.

In further discussion, D. Foley of the Michigan Central, and Henry Hessmer of the same road, both held that all switch points should be reinforced as a matter of safety. J. C. Rockhold of the Santa Fe preferred the "Channel" switch because of its more exact fitting. The question of whether the point of a switch should be higher than the stock rail being raised, P. H. McFadden of the Pere Marquette, Mr. Dickson of the Northwestern and Mr. Rockhold of the Santa Fe all said that their experience had been that the switch point should be of the same height as the stock rail. C. P. Dickson of the Northwestern made a motion, which was carried, that it was the sense of the meeting that all split switches on main tracks, where high speed is required, should be adjustable ones. The same action was taken on a motion of Mr. Hickey's, that all split switch points should be planed to a level with the stock rail.

A motion by Mr. J. M. Meade of the Santa Fe road that the Executive Committee be empowered to employ some competent person to prepare a code of standard switches, frogs, etc., for the use of roadmasters, provoked a lengthy discussion, but was finally carried.

Reversing Alternate Bolts in Joints.—Mr. G. W. Merrell, of the Norfolk & Western, presented the following paper which was generally approved.

The office of the bolt is to hold the angle bars rigidly in place. This would be done perhaps equally well with the bolt heads all in one direction; but a close study of the varying conditions and requirements will show that there are excellent reasons why the joints should not be held by bolts placed with heads all on either outside or inside of the rail. Where heads are all on one side of the rail, the shoulders on bolts in slots in the angle bars throw on one angle bar a large proportion of the strain caused by expansion and contraction of the rails, and the result is frequently breaking of the bolts, and the crowding of the joint out of line. By reversing half the bolts the strain is equalized between the two angle bars, and there is less liability of the breaking of bolts, and joints will be more easily maintained in true gage. Again the staggering of the slots for spikes in angle bars makes it impossible to avoid placing some of the slots so nearly under the bolt holes that when a nut is placed over such a slot, it is impossible to drive or pull the spike without removing the bolt. By alternating or staggering the bolts, it can be done in such a manner that the head, instead of nut, will be placed over such slots, and the head will be found not to interfere with the driving or pulling of spikes. The advantage gained by this manner of bolting is particularly noticeable when spacing joint ties under rail newly laid, much time being saved in spiking. By far the weightier reason, however, for staggering bolts at joints is that it reduces very materially the liability of excessive damage in case of derailment. Frequently only one pair of wheels may be derailed, in which case the wheels striking the nuts, will shear every bolt for long distances. When the rails remain in line and gage but little damage may result, but should they become displaced sufficiently to derail following cars, the most disastrous results are almost certain to ensue. A derailed wheel will not shear the heads of bolts, and if the bolts at joints are staggered, all the bolts cannot be destroyed.

The question of the "Best Method of Tamping Ties with the Different Kinds of Ballast" was considered briefly and brought forth the views that the tamping bar and the shovel are almost invariably used. In this connection Mr. Rockhold, of the Santa Fe, raised a question as to what course should be pursued when it was found that a roadbed is constantly sinking, although it is continually being filled in with ballast. President Rice said that he had once encountered this difficulty and had continued filling in and when he had at last found a solid bottom he had an elevation of about two feet whereas he had filled in a depth amounting to sixty feet. Mr. J. M. Meade, Santa Fe, offered the only other solution, saying that he had had an experience of the same kind, and overcome the difficulty by driving piles along the outside of the roadbed and filling the bed with stone.

Mr. Walter E. Emery, Chicago & Northwestern, read a short paper on "The Best Methods of Handling Different Kinds of Ballast," which was but briefly discussed.

Preservative Treatment of Cross Ties.—Mr. J. M. Meade, Atchison, Topeka & Santa Fe, presented a very brief statement of the treatment of ties on that road. He said in part:

The Santa Fe was the first of the Western roads to go into this subject. This was in 1885, 15 years ago, and I have reports showing that some of these are still in the track, which is certainly a remarkable record, considering that the ties that were treated were mountain pine of New Mexico, the average life of which without treating, is about four years. We consider the Wellhouse process much better than the Burnitized method, which consists simply of chloride of zinc. During the years 1898 and 1899 very close figures were kept as to the cost of treating ties at the Las Vegas plant. For the year 1898 the cost for ties containing four cubic feet, was:

Chemicals	$0.1097
Labor	0.0250
Fuel and supplies	0.0031
Total cost per tie, f. o. b.	$0.1378

The absorption of zinc per cubic feet was .518 per cent.

In 1899 the average for treating a tie was as follows:

Chemicals	$0.1211
Labor	0.0226
Fuel and supplies	0.0033
Total per tie f. o. b.	$0.1470

The average absorption of zinc per cubic foot was .523 per cent.

It will be seen from these figures that the average cost of treating for the two years above mentioned was $0.1424 per tie, or practically 14½ cents per tie f. o. b. The Santa Fe now have three large plants established, one on the Gulf, Colorado & Santa Fe, at Somerville, Tex., with a daily capacity of about 6,500 ties; one at Las Vegas, N. Mex., with a daily capacity of about 2,500 ties, and one at Bellemont, Ariz., with a daily capacity of about 2,100 ties.

An amendment to the Constitution and By-laws was offered, proposing a change of name to "The Railway Maintenance of Way Association"; this was not accepted. A motion, however, was carried that the name of the Association be changed to "The Roadmasters' and Maintenance of Way Association of America."

The following officers were elected for the ensuing year: *President*, J. M. Meade, Atchison, Topeka & Santa Fe; *First Vice-President*, Charles McEniry, Burlington, Cedar Rapids & Northern; *Second Vice-President*, G. E. Hayward, Chicago, St. Paul, Minneapolis & Omaha; *Secretary and Treasurer*, J. B. Dickson, Chicago & Northwestern. M. Sullivan, Michigan Central, was elected a member of the Executive Committee. The next annual meeting will be held at Washington, D. C., on the second Tuesday in October.

After the conclusion of the business sessions, short excursions were made by the members of the association and their friends to Santa Monica Beach, to the Catalina Islands and to Mount Lowe.

The Isthmian Canal in Congress.

The main facts concerning the status of the canal question in Congress should now be recited briefly.

I. The Hay-Pauncefote Treaty of Feb. 5, 1900, is yet in the hands of the Senate unratified, and the negotiations are still alive. The ratification of the treaty as it now stands would admit Great Britain and other European powers to joint political control of this American waterway. They would become guarantors of the neutrality of the canal, in time of war as in time of peace; and theirs would be the right and the duty to enforce neutrality even against ourselves, in any war in which this country was engaged. The Hay-Pauncefote Treaty allows us to construct the canal, to pay for it and to operate it as a trustee for the world's commerce; it prohibits the fortification of the canal by us.

II. The Hepburn Canal bill passed the House of Representatives on May 2, 1900. It had not passed the Senate when Congress adjourned. The bill is now in the Senate, and has been made the special order for the afternoon of Monday, Dec. 10. The canal proposed by this measure is an American canal, in fact as well as in name. Without reference to the Hay-Pauncefote negotiations, and independently of the provisions or restrictions of the proposed treaty, the Hepburn bill authorizes the President to acquire from Costa Rica and Nicaragua the necessary territory, and to pay for the same; it empowers the Secretary of War to proceed to construct the canal; it empowers him likewise to fortify it; and it limits the total cost to $140,000,000, directly appropriating $10,000,000 for beginning the work. The idea of neutrality and of supervision to be exercised by other governments over our control of the canal does not enter.

III. A commission of engineers and distinguished citizens, appointed many months ago by the President to investigate the different routes across the isthmus, the Nicaragua route, the Panama route and any others, has not yet reported.

IV. Recent unofficial statements represent the State Department as having succeeded in negotiating with the Central American republics a satisfactory arrangement for the purchase by this Government of the territorial rights in Nicaragua and Costa Rica which are necessary for the construction of the canal—*New York Sun.*

Acetylene Gas for Car Lighting.

We have somewhat recently printed a paper on the use of acetylene gas for car lighting, which was written by Mr. Lipschutz, of the Great Northern Railway. He has been for some time engaged in developing a system of car lighting by acetylene gas, and speaks as an expert and as an advocate of that method of lighting. Consequently, what follows is of particular interest as coming from him. It is part of a letter recently printed in the *Railway Age* in reply to an article on this subject by Mr. J. M. Morehead.

Mr. Morehead states that acetylene gas, compressed, is no more dangerous than any other illuminating gas, compressed. This is a very serious error. To persuade himself that he is mistaken, all that is necessary to do is to take a piece of pipe, fill same, say, with 150 pounds compressed acetylene gas, and after this pipe is closed on both sides, heat the same to about 1,430 deg. Fahrenheit. If this pipe is filled with Pintsch gas, nothing will happen to the pipe, but as acetylene, when compressed to over 30 pounds, dissociates at 1,432 degrees Fahrenheit instantly and with terrific force, the pipe used in this experiment will be blown into pieces. The same holds good, of course, for the tanks which he proposes to use under coaches. Should a car be wrecked and catch fire, or should the car, by accident, stand over hot cinders or burning ties, sufficiently to heat the gas in the tank under the car, or only the pipes under the car, to a temperature of 1,432 degrees, an explosion is absolutely un-

avoidable. We have, therefore, in the Great Northern Railway system made use of tanks which have soft soldered seams lengthwise as well as around the heads, and make all our high-pressure pipes under the car of a fusible material. It is thereby impossible to raise the temperature of the gas in tanks or in the pipes to more than 400 degrees Fahrenheit without springing a leak, which lets the gas stream out and burn, and thereby excludes all possibilities of an explosion. This construction we have covered by United States patents.

He further states that a pressure of 300 pounds might be used in the tanks of the coach. This is not practical, as in order to charge the car tanks with 300 pounds of compressed acetylene gas, it will be necessary to carry, say, at least 400 pounds' pressure in the main supply tank, and in winter with a temperature of about 35 degrees below zero this would make acetylene liquid, the point which is to be avoided.

He further states that the Pintsch gas equipment on cars, as it is now, could be used entirely, excepting for the change of the burner tips. This is not true, as the requirements for acetylene are altogether different ones from Pintsch gas. One of the main reasons why Pintsch gas lamps cannot be used for acetylene is, that the gasway in the Pintsch lamp is central and is heated by surrounding burners, therefore heating the gas, which is all right for Pintsch gas but detrimental to acetylene gas to such a degree that in a sleeper running at the present time with acetylene gas, but having Pintsch gas lamps, we have to renew our burners more than once a month, although our gas is generated cool and purified and dried before placed on the car.

It is also a mistake to think that any compressor might be used for compressing acetylene gas. Take the Pintsch gas compressor, for instance, and you will find that the gas leaves the discharge valves of the compressor at a temperature much higher than the polymerization temperature of acetylene. Now, in order to get full candlepower out of acetylene gas, it is requisite that during generation, purifying, drying, compressing, storing, and until it leaves the burner tips, it be not subjected to a heat sufficient to polymerize the gas. We have, therefore, found it necessary to design and build a special compressor for this gas, which has fulfilled its purpose, and can be seen in daily operation.

American Road Builders in Porto Rico.

BY ALBERT WELLS BUEL.

In November and December, 1899, the United States Military Government of Porto Rico let a series of contracts for the building of highways which, with those assigned in April of the present year, amount to more than $1,100,000. Of this sum, about one-half had been expended on July 1, 1900, and it is expected that the rest will be worked out early in the coming year. These contracts, which cover something more than 100 miles of road, are indicated by the broken lines on the accompanying map (Fig. 1) of the island.

The following table is a compendium of the macadamized highways which were found in Porto Rico at the time of American occupation in 1898, and are all that the Spanish authorities had succeeded in building after several centuries of effort. Except in a few cases, it will be seen that the broken lines (roads under construction or projected) are continuations of the Spanish highways.

From.	To.	Miles.
San Juan	Ponce	83.10
Cataño	Toa Alto	14.25
Mayaguez	Afiasco	5.60
Mayaguez	Hormigueros	8.65
Cayey	Guayama	16.15
Ponce (toward)	Adjuntas	9.30
Utuado (toward)	Arecibo	3.10
Rio Piedras	Fajardo	19.85
Total		160.00

When the work now in progress is completed there will be a beautiful road from Ponce to Arecibo, 51 miles long, which, in connection with the French railway (1 meter gage), will reduce the time and cost of transportation between San Juan and Ponce. The French railroad was projected as a belt line to encircle the whole island, and about 125 miles are completed, leaving about 150 miles yet to be done. The work of construction on this part was stopped by the war, but preparations are in hand to resume it. Sugar will always form a large part of its traffic, because the line traverses the entire sugar zone, but when completed it will collect coffee, tobacco and other products, which will come to it over the highways from the interior, and carry them to the various ports along the coast.

The most difficult of all the lines is said to be that between Camuy and Aguadilla; more costly, in fact, than all the rest of the work put together since, in addition to ordinary road building, it involves a high viaduct and two tunnels. It also offers a few surprises which are well worth a long journey to see. The rivers Camuy and Guajataca perform the unusual feat of disappearing and flowing underground for five miles, then coming to the surface and again disappearing for another five miles.

The chief object of the road building, undertaken at this particular time, was to furnish occupation and food to the peons, who were starving, but the result will be to offer an outlet to the best coffee in the world. The roads from Aguadilla to Lares, Mayaguez to Las Marias, Manati to Morovis and Toa Alfo to Corozel, will make new districts accessible, but the country around Utuado, Lares, Yauco, Comerio and Barros will still be, to a large extent, unapproachable and in pressing need of relief.

The contractors, who have taken work in isolated parts of the country, have had some interesting experiences. It has been no uncommon thing to see men rolling large stones (afterwards to be converted into road-metal) for 200 or 300 ft. up a steep bluff or the sides of a canyon. Much of the road-metal was distributed over distances approximating a half mile, by two men carrying a box suspended on two poles which contained about a cubic foot of material. A pony bearing two boxes, one on each side, like saddle-bags, and containing a total of 3 cu. ft., is in Porto Rican economics, an advanced stage of development in the art of transportation.

The modern Spanish bridges on the island are generally riveted steel trusses, but while they are, in most cases, well designed and built, the excessive humidity of the climate makes them expensive to maintain, since they must be repainted every year. Capt. Judson, the Engineer Officer in charge of the new works, selected concrete and, in special cases, armored concrete, as the material best suited to the conditions, where the length of span or some other unsurmountable cause did not preclude their use. Mr. Edwin Thatcher, M. A. M. Soc. C. E., as designer and contractor, is building two armored concrete bridges. Of these, that over the Jacaguas River consists of two 100-ft. and one 120-ft. arch spans. The other, over the Guaya River, is of three 70-ft. arches. No new steel bridges are contemplated, although six are now being erected, ranging from 20 ft. to 256 ft. in length of span. Four of these are being repaired and re-erected at their original sites; the other two never had been used, but were bought by the Spanish Government for use at places different from their present locations.

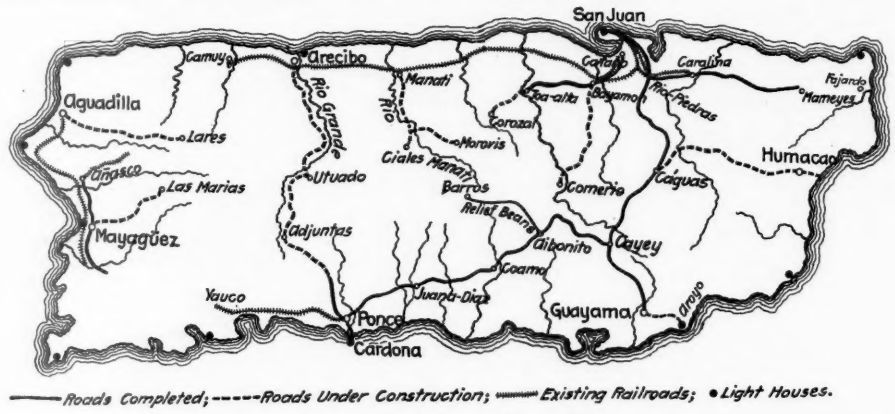
Under the general specifications controlling this highway work, there have been built many arches of considerable spans, and others are under construction. Fig. 2, one of these, crosses the Rio Grande in the village of Adjuntas. The span is 55 ft., springing from the mother rock in the banks; the intrados is an ellipse (not a many-centered curve, a make-shift which has spoiled the appearance of so many arches) with a segmental extrados, and the true line of pressure follows the neutral axis very closely around the ring. Because this arch is in a remote situation, no decoration of any sort was used, and, except in line, it makes no pretension to beauty. For general purposes the Department of Roads has standard plans of concrete arch culverts, as follows:

Pipe Drains of Concrete with Dimension-Stone End-Walls up to 18 in. Diameter.

Arches,	3 ft.	Span,	6 in.	Rise,	6 in.	Thickness of Crown.		
"	4 ft.	"	12 in.	"	6 in.	"	"	"
"	6 ft.	"	18 in.	"	6 in.	"	"	"
"	8 ft.	"	24 in.	"	6 in.	"	"	"
"	10 ft.	"	30 in.	"	8 in.	"	"	"
"	12 ft.	"	36 in.	"	9 in.	"	"	"
"	15 ft.	"	45 in.	"	12 in.	"	"	"

Arches,	4 ft.	Span,	2 ft.	Rise,	6 in.	Thickness of Crown.		
"	6 ft.	"	3 ft.	"	6 in.	"	"	"
"	8 ft.	"	4 ft.	"	6 in.	"	"	"
"	10 ft.	"	5 ft.	"	8 in.	"	"	"
"	12 ft.	"	6 ft.	"	9 in.	"	"	"
"	15 ft.	"	7 ft. 6 in.	"	12 in.	"	"	"

Arched culvert in steep ravine with deep catch-basin and horizontal passage.



——Roads Completed; -----Roads Under Construction; ——Existing Railroads; • Light Houses.

Fig. 1.—Sketch Map of Porto Rico.

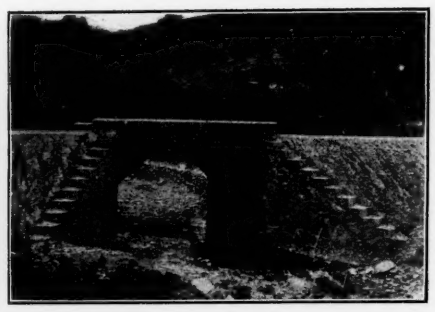
Arched culvert in steep ravine with paved steps.

Arched culvert in steep ravine inclined bed with invert (For solid rock formations).

Arched culvert in steep ravine, hor. bed at high level; built only in embankments and re-inforced with steel rods so that it shall act as a tubular girder of armored concrete when embankment settles.

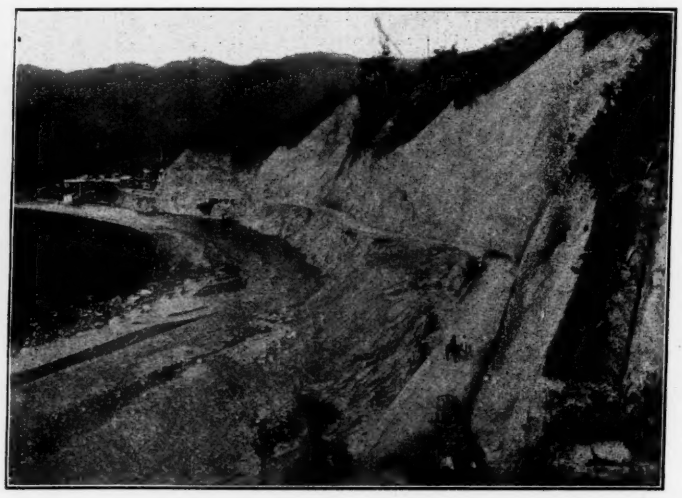
Although the crown thicknesses of the above-named list are considerably less than would be provided for voussoir rings of brick or cut stone, they are nevertheless much thicker than is ordinarily thought necessary for the stability (including a rational factor of safety)

Fig. 2.



Concrete Arches. Fig. 3.

Fig. 4.



On the Road Between Ponce and Arecibo. Fig. 5.

of monoliths. This extra strength was provided because of the peculiarly difficult conditions surrounding the work; namely, long distances through which the cement must be carried in a humid atmosphere and the inexperienced labor which must necessarily be employed. However, by the exercise of great care and a close inspection, all of the concrete put in so far has proved of fine quality. In one case, where it became necessary to remove some but a few days old, drilling and blasting was found to be the only means of disturbing it.

Besides the work already described, there has been a certain amount of rough grading, paid for in rations (known in the vernacular as "relief beans") by the Commissary Department of the United States Army. The best piece of work of this sort was done by Capt. H. W. Wheeler, of the 5th Cavalry, who attacked the wretched mountain trail, difficult even for ponies, between Aibonito, Barranquitas and Barros, and succeeded in putting through a graded road on the whole distance of about 16 miles, except for about three miles in one place and half mile in another. The hiatus exists solely because the "relief" was withdrawn. Some of the energy and push which must have been back of this effort may be conceived when it is understood that practically all of the work was performed with hoes, which the peons possessed, since Capt. Wheeler had but 12 shovels available and no other tools or plant of any sort. This road is marked on the map as "Relief Beans."

The standard sections for typical locations show very heavy work, and highways in Porto Rico cannot be built for much less than $15,000 a mile. The maximum gradient on the mountain roads is 7 per cent. and the minimum curvature, 60 ft. radius; that portion of the road between San Juan and Ponce which was built before the American occupation, has gradients of 8½ and 9 per cent.

A principal item in the cost of work in Porto Rico is transportation. A barrel of Portland cement, which may be worth at the coast about $3, may easily be doubled in value when it reaches the interior, since a pair of oxen and cart cannot take more than five barrels, and the haul may be 30 or 40 miles over bad roads.

The American Board of Public Works has established a physical laboratory which is equipped with apparatus for every cement test, except that of compression. The ordinary 7 and 28 days test of neat and mixed cements (cement, 1 part; standard crushed quartz, 3 parts) are applied to all purchases, and in addition, the "accelerated tests" recommended by Mr. W. W. McClay, M. Am. Soc. C. E. Pats are also made and tested for constant volume, in steam and in hot water for various periods.

For ordinary concrete, the proportions are 1 part of packed cement, 3 parts of sand and 5 parts of broken stone, which will pass through a ring 2 in. in diameter. For arch rings, the proportions to 1 part of packed cement are, 2 of sand and 4 of 1¼-in. stone. Nothing but Portland cement is used, and the amount of water is limited to that which is not followed by "quaking."

On all exposed surfaces a 1-in. thickness of mortar in the proportions 1 to 2 is placed (simultaneously with the concrete) next to the inner surface of the forms; all plastering or pointing is forbidden, except by special permission, but the surfaces of arches, copings and parapets are finished by means of a float and a wash of cement grouting.

Fig. 3 is a concrete arch on the road between Ponce and Arecibo. Figs. 4 and 5 are views on the same road in the vicinity of Utuada.

Train Accidents in the United States in October.

COLLISIONS.

Rear.

5th, on Wisconsin Central, at Neenah, Wis., a passenger train ran into a freight which was standing on the main track in the yard; two trainmen injured. It is said that the flagman of the freight did not go out soon enough.

7th, on Philadelphia & Reading, at Bowmansdale, Pa., a freight train ran into the rear of a preceding freight, and the caboose was badly damaged. The engineman was killed.

7th, on Western & Atlantic, near Graysville, Ga., a freight train which had stopped between stations to load some freight was run into at the rear by a following freight; engine, caboose and four cars wrecked; engineman injured. It is said that the conductor of the standing train had left word at the last preceding station warning the next train.

7th, on Philadelphia & Reading, at Grantham, Pa., a freight train standing at the station was run into at the rear by a following freight and the engineman, who was beneath his engine making repairs, was killed.

8th, on Norfolk & Western, near Radford, Va., a work train ran into the rear of a preceding freight train, wrecking the caboose and one car. One trainman was injured.

15th, on New York Central & Hudson River, near Buffalo, N. Y., an empty engine ran into the rear of a preceding passenger train, doing slight damage. One passenger was injured.

16th, on Oregon Short Line, at Topaz, Idaho, a passenger train ran into the rear of a preceding freight and the engine fell down a bank. A tramp was killed and two trainmen and one tramp were injured.

16th, on Long Island road, at Nassau, N. Y., a freight train ran into the rear of a preceding passenger train which was standing at the station. One passenger and one trainman were injured.

16th, on Southern Pacific, at San Leandro, Cal., two engines drawing a caboose ran into the rear of a preceding freight train, wrecking the caboose of the freight. A man in this caboose was injured. There was a dense fog at the tmie.

16th, 10 p. m., on Missouri, Kansas & Texas, near Letot, Tex., a freight train ran into the rear of a preceding freight, wrecking the engine and several cars. The wreck took fire and was partly burned up. One trainman was injured.

17th, on Philadelphia & Reading, at Rossmoynes, Pa., a freight train standing at the station was run into at the rear by a following freight, and the conductor, who was in the caboose, was killed.

24th, on Southern Pacific, at Davisville, Cal., a passenger train ran over a misplaced switch and into some freight cars standing on the side track, damaging the engine and three cars. A mail agent was injured.

25th, 3 a. m., on Erie road, at Attica, N. Y., a freight train ran into the rear of a preceding freight, badly damaging eight cars. One fireman was injured.

26th, on Illinois Central, at Chatawa, Miss., a freight train which had been unexpectedly stopped was run into at the rear by a following freight, and the caboose was wrecked. Three drovers in the caboose were killed. There was a dense fog at the time.

26th, on Cleveland, Cincinnati, Chicago & St. Louis, at Sandusky, Ind., a mixed train descending a grade broke in two and the rear portion afterward ran into the forward one, wrecking five freight cars. Three passengers were injured.

27th, 4 a. m., on Delaware, Lackawanna & Western, near Henryville, Pa., a freight train ran into the rear of a preceding freight, damaging several cars. A brakeman was injured.

27th, on New York Central & Hudson River, near Beech Creek, Pa., a freight train ran into the rear of a preceding freight which was standing at a tank, wrecking the engine and caboose. Three trainmen and another man in the caboose were injured, two of the brakemen fatally.

27th, on Union Pacific, near Gothenberg, Neb., a freight train which had reduced speed was run into at the rear by a following freight, wrecking the engine, caboose and five cars. A drover and two trainmen were injured. There was a dense fog at the time.

27th, on Great Northern, near Holyoke, Minn., a freight train ran into the rear of a preceding work train, making a bad wreck, which took fire and was burned up. Two employees were burned to death.

27th, 10 p. m., on Cleveland, Cincinnati, Chicago & St. Louis, at Dayton, Ohio, a freight train drawn by two engines ran into the rear of a preceding switching freight train, and two engines and three cars fell into a canal, the collision having occurred on a bridge. Two trainmen were injured.

28th, on Boston & Maine, at Waltham, Mass., a local freight train was run into at the rear by a following through freight and the caboose was wrecked. Two trainmen were injured.

29th, 4 a. m., on Chicago & Northwestern, at Port Washington, Wis., a freight train standing at the station was run into at the rear by a following freight, and the caboose, two engines and several cars of grain were wrecked. Two trainmen were injured.

29th, on Lake Erie & Western, at Denver, Ind., passenger train No. 25 ran over a misplaced switch and into some platform cars standing on a side track, wrecking three freight cars. The engineman and fireman were injured.

30th, on Southern Railway, near Nurney, Va., a wrecking train ran into the rear of a preceding gravel train, wrecking several cars. The wreck took fire and four cars were burned up; six employees were injured.

30th, on Chicago & Alton, near Mitchell, Ill., a passenger train ran into the rear of a preceding freight, and a mail car next to the engine was wrecked. One mail clerk was killed and six were injured.

30th, on Chicago & Alton, near Lincoln, Ill., passenger train No. 4 ran into the rear of a preceding freight, which was entering a side track. A man sleeping in the caboose of the freight was killed.

30th, on Atlantic Coast Line, near Gates, N. C., rear collision of freight trains; one trainman injured.

31st, on Alabama Great Southern, at Birmingham, Ala., a freight train, the speed of which was not properly controlled, ran over a misplaced switch and into a freight train standing on a side track. A trackman sleeping in the caboose was injured.

And 21 others on 14 roads, involving 3 passenger and 33 freight and other trains.

Butting.

5th, on Central of Georgia, near Tennille, Ga., butting collision of freight trains, wrecking both locomotives and piling upon them about 15 cars. It is said that the westbound train had gone beyond the appointed meeting station.

6th, on New York Central & Hudson River, near Port Byron, N. Y., butting collision of freight trains; one engineman injured.

7th, on Chicago, Indianapolis & Louisville, near Monticello, Ind., butting collision of passenger trains, badly damaging both engines and the baggage cars. Three trainmen were injured.

11th, 10 p. m., on Colorado & Southern, near Littleton, Col., butting collision between a passenger and a freight, badly damaging one engine and one car. One engineman was killed. It appears that the freight train, which ran past a station and having difficulty in backing into the side track, had sent out a brakeman with a red and a white lantern; but the red lantern went out and the brakeman appears to have been unable to give an effective signal with the white light.

12th, on Burlington road, at Plattsmouth, Neb., a passenger train ran over a misplaced switch and into the head of a passenger train standing on the side track, wrecking both engines and badly damaging several cars. One engineman was killed and two other trainmen were injured.

18th, on Vandalia Line, at East St. Louis, Ill., butting collision of freight trains, badly damaging both engines. A policeman riding on one of the trains was injured. There was a dense fog at the time.

20th, on Richmond, Fredericksburg & Potomac, near Richmond, Va., a southbound passenger train ran over a misplaced switch and into the head of a northbound passenger train, badly damaging both engines. One passenger and one trainman were injured.

24th, on Illinois Central, at Hallidayboro, Ill., passenger train No. 4 ran over a misplaced switch and into the head of a freight train standing on the side track, damaging both engines and several cars. One engineman and one fireman were injured, the latter fatally.

24th, 8 p. m., on Southern Pacific, near Lafayette, La., butting collision between an excursion passenger train and a freight. One passenger and one engineman were injured.

25th, 5 a. m., on Southern Railway, at Columbus, Miss., collision between a freight train and a yard train, badly damaging both engines. One engineman was killed and three other trainmen were injured.

27th, 1 a. m., on Pittsburgh, Cincinnati, Chicago & St. Louis, at Onward, Ind., butting collision of freight trains, in consequence of the eastbound train having run a short distance beyond its appointed meeting place; the engines and three cars were wrecked and one fireman was killed. One engineman was injured. There was a dense fog at the time.

28th, on Nashville, Chattanooga & St. Louis, at Stevenson, Ala., butting collision of freight trains, the westbound train having passed the station to enter a side track at the west end instead of entering a siding at the east end as ordered. One engineman and one fireman were injured.

30th, on Baltimore & Ohio, at Geiger, Pa., butting collision of freight trains; two trainmen injured.

31st, on Chicago & Alton, near Marshall, Mo., butting collision of freight trains; one engineman killed.

And 11 others on 10 roads, involving 3 passenger and 19 freight and other trains.

Crossing and Miscellaneous.

3rd, near Cairo, Ill., a switching freight train of the Mobile & Ohio ran into a freight train of the Cleveland, Cincinnati, Chicago & St. Louis at the crossing of the two roads and one of the engines was overturned. One engineman was injured.

6th, on Great Northern, near Edmonds, Wash., collision between a passenger train and a freight; both enginemen killed and two passengers injured.

11th, 8 p. m., on Central of New Jersey, near Bound Brook, N. J., collision of freight trains; one engineman killed.

12th, on Central of Georgia, at Macon, Ga., collision of freight trains; two trainmen injured.

14th, at Garland, Tex., a passenger train of the Missouri, Kansas & Texas ran into a freight on the Gulf, Colorado & Santa Fe at the crossing of the two roads, damaging both engines. It is said that the train on the Santa Fe had become uncontrollable by reason of difficulty with the air-brake.

14th, 9 p. m., near Springfield, Ill., a locomotive and two cabooses of the Wabash road ran into a freight train of the Illinois Central at the crossing of the two roads, wrecking four cars of the freight train and the engine and one caboose of the other train. Three trainmen were injured. It appears that there are no signals at the crossing and that the Wabash train stopped 200 ft. before crossing. At this point the engineman, seeing the light on a switch beyond the crossing, assumed that his route was clear; and the fireman confirmed the engineman's opinion; but the Illinois Central train was crossing nevertheless, and the clear view of the switch light was due to the fact that all of the cars in that portion of the train which was then passing were gondolas or platform cars.

17th, on Rutland road, near Cuttingsville, Vt., a freight car which escaped control on a steep grade collided at high speed with a passenger train; the fireman jumped off and was badly injured.

19th, on Philadelphia & Reading, at 30th street, Philadelphia, Pa., several cars of a freight train escaped control while being switched and collided with a freight train standing in the tunnel. Two cars were wrecked and the wreck took fire, one of the cars being loaded with sulphur. Fire engines were quickly brought and the fire was controlled, but two cars and their contents were burnt up.

20th, on Delaware, Lackawanna & Western, near Buffalo, N. Y., a freight train ran into a work train, making a bad wreck. Two employees were killed and one was injured.

21st, 1 a. m., on Boston & Maine, at Waltham, Mass., a freight train running through a crossover was struck by another freight approaching on the main line at good speed, and 20 cars were wrecked. A passenger brakeman riding on one of the trains was killed.

21st, on Philadelphia, Wilmington & Baltimore, at Washington, D. C., collision between trains of empty cars being switched in the yard, due to misunderstanding of a signal; two trainmen injured.

24th, 4 a. m., on New York, New Haven & Hartford, near New Haven, Conn., collision of freight trains in a yard, wrecking several cars. Three trainmen were injured, one of them fatally.

24th, on Chicago & Eastern Illinois, near St. Elmo, Ill., a passenger train collided with a freight which, it is said, had encroached on the time of the passenger without authority. There was a dense fog at the time. One employee was killed and the passenger engineman was injured.

25th, on Lake Erie & Western, at Peru, Ind., a passenger train collided with a switching engine which had just been run from a siding to the main track. The engineman jumped off and was fatally injured; the fireman was considerably bruised.

25th, on St. Louis, Iron Mountain & Southern, at Mer Rouge, La., collision between a freight train and a switching engine, wrecking two cars and damaging 10 others. One engineman was killed.

31st, on New York Central & Hudson River, at Geneva, N. Y., collision between a freight train and a switching train; one brakeman injured.

And 36 others on 24 roads, involving 11 passenger and 52 freight and other trains.

DERAILMENTS.

Defects of Roadway.

4th, 3 a. m., on Southern Pacific, near Kelton, Utah, a freight train drawn by three engines was derailed by a loose rail and all of the engines and nine cars were ditched. The conductor was injured.

17th, 4 a. m., on Galveston, Harrisburg & San Antonio, at Finlay, Tex., a freight train broke through a bridge which had been weakened by a flood, and the engine and six cars were wrecked. The engineman and fireman were killed.

19th, 7 p. m., on Illinois Central, at New Athens, Ill., a freight train was derailed while crossing a bridge, and 10 cars, with the wrecked bridge, fell to the river below. A tramp was injured.

22nd, on Denver & Rio Grande, at Kelker, Colo, the locomotive of a freight train broke through a bridge and fell to the ravine below. The engineman and fireman were injured. The bridge had been damaged by fire and had been temporarily repaired, but appears not to have been put in a safe condition.

25th, on Union Pacific, near David City, Neb., a passenger train was derailed by a broken rail and two passenger cars were overturned in the ditch. One passenger was killed and another injured.

28th, 11 p. m., on Northern Pacific, at Dehart, Mont., eastbound passenger train No. 4 was derailed by the breaking of a switchrod and the first three cars were overturned and ditched. Seven passengers were killed and 10 passengers and two trainmen were injured.

30th, on Pawnee Railroad, near Auburn, Ill., a mixed train was derailed by a broken rail and the passenger car and one freight car fell down a bank into a creek and were wrecked. One passenger and the Superintendent of the road were injured.

And 7 others on 5 roads, involving 1 passenger train and 7 freight trains.

Equipment.

8th, on Baltimore & Ohio, at Evitt's Creek, Md., sev-

eral cars of a freight train were damaged by the sudden stopping of the train in consequence of the automatic application of the air-brakes and two trainmen were injured.

15th, on Bangor & Portland, near Martin's Creek, N. J., a passenger train was derailed by a broken axle and a passenger car was overturned. Of the 25 passengers in this car only a few were injured, and those not seriously.

15th, 10 p. m., on Oregon Railroad & Navigation, near Oneonta, Ore., a freight train was derailed by a broken flange and a tramp was injured.

17th, 11 p. m., on St. Louis, Iron Mountain & Southern, near Nowata, I. T., a passenger train was derailed by the breaking of a truck of the tender and the baggage car was wrecked. Several passengers were injured.

19th, on Philadelphia & Reading, near New Franklin, Pa., a freight train was derailed by a broken brake-beam and two cars were wrecked. A brakeman was injured.

22nd, on Lake Shore & Michigan Southern, at 44th street, Chicago, an excursion passenger train was derailed by a broken truck and eight passengers were injured.

24th, on Pittsburgh, Cincinnati, Chicago & St. Louis, at Carnegie, Pa., a westbound fast mail train was derailed by a broken flange; a mail clerk jumped off and was injured.

29th, on Louisville, Evansville & St. Louis, near Princeton, Ind., a passenger train was derailed by the breaking of a flange of one of the truck wheels of the engine, and the engine was overturned. The engineman was killed and three other trainmen were injured.

31st, on Ohio Central, near Bucyrus, Ohio, a freight train was derailed by a broken flange, making a bad wreck. A trainman was injured.

And 14 others on 9 roads, involving 2 passenger and 12 freight and other trains.

Negligence in Operating.

16th, on Chicago & Alton, near Lawndale, Ill., a freight train was derailed at a point where a rail had been removed from the track by repair men, and 17 cars were wrecked. The engineman and two other trainmen were killed and three others were injured.

30th, on Pittsburgh, Bessemer & Lake Erie, at Pennside, Pa., several cars of a freight train were derailed by a long bridge girder which fell from a car as the train was passing the station. Four cars went through the station building, and wrecked it, but no person was injured.

And 12 others on 11 roads, involving 3 passenger and 9 freight and other trains.

Unforeseen Obstructions.

7th, on Midland Terminal, at Anaconda, Colo., a work train was derailed by stones which had been piled on the track by children and the engine fell down a bank and was wrecked. A brakeman was killed and the engineman and fireman were injured.

10th, on Chicago & Northwestern, at Marinette, Wis., a freight train switching near a lumber yard was derailed by an accidental obstruction; one employee was killed and another was injured.

11th, on Central Pennsylvania & Western, near Jerseytown, Pa., a mixed train was derailed by a tree which had fallen upon the track, and the engine and four freight cars fell down a bank. The wreck took fire and was burned up.

12th, on St. Louis, Iron Mountain & Southern, at Dumas, Ark., a southbound passenger train was derailed by running over a tree which had fallen across the track, and the engine and baggage car were ditched. The engineman and fireman were injured, the former fatally.

14th, 1 a. m., on New York Central & Hudson River, near West Point, N. Y., a freight train drawn by two engines was derailed by a landslide and the engines and several cars were wrecked. Two trainmen were injured.

14th, 1 a. m., on Gulf, Colorado & Santa Fe, near Lampasas, Tex., a freight train was derailed by running over a horse, and many cars were wrecked. Eleven cars took fire and were burned up. The fireman was killed and the engineman fatally injured.

14th, on Evansville & Terre Haute, at Purcell, Ind., a freight train was derailed by running over a cow and 18 cars were wrecked. Four of the cars contained oil, which took fire, and the wreck was burned up. Four trainmen were injured.

14th, 9 p. m., on Lake Shore & Michigan Southern, at South Chicago, Ill., a passenger train was derailed at a switch which it is said had been maliciously unfastened, and the engine, two mail cars and two express cars were wrecked. The fireman and a tramp were killed and the engineman was fatally injured. Two other employees were injured.

17th, on San Antonio & Aransas Pass, near Gurley, Tex., passenger train No. 42 was derailed by running over a cow, and the engine fell down a bank. The fireman was fatally injured and six passengers were injured.

18th, on Northern Pacific, near Eddy, Mont., a passenger train was derailed by a landslide. Three trainmen were injured, one of them fatally.

19th, 10 p. m., on Pittsburgh & Lake Erie, near Pittsburgh, Pa., a passenger train ran into a pair of horses drawing a wagon and one of the passenger cars was derailed and considerably damaged. Two of the men in the wagon were killed.

21st, on Pennsylvania road, near Howard, Pa., a freight train was derailed by running over a cow, and the engine and 12 cars were wrecked. The engineman, fireman and two tramps were killed and a brakeman was fatally injured.

23rd, on New York Central & Hudson River, near Tiadaghton, Pa., a freight train was derailed by running into a landslide, and the engine and 20 cars were ditched. The fireman was killed.

23rd, 11 p. m., on Great Northern, near Ballard, Wash., a freight train was derailed by a landslide, and the engine and 10 cars were wrecked. The wreck took fire and the cars were burnt up. The engineman and another man were killed and two trainmen and one passenger were injured.

31st, on Gulf, Colorado & Santa Fe, at Crowley, Tex., a special train carrying officers of the road was derailed by sand which had been washed upon the track; engineman and fireman injured.

And 3 others on 3 roads, involving 1 passenger train and 3 freight trains.

Unexplained.

1st, on Chicago, Burlington & Quincy, near Chariton, Iowa, a passenger train was derailed and wrecked. One passenger was killed and six were injured.

1st, on Southern Railway, near Donovan, Tenn., a freight train was derailed and several cars were wrecked. Three tramps were injured.

2nd, on Louisville & Nashville, near Columbia, Tenn., a freight train was derailed and a brakeman was killed.

2nd, on Charleston & Savannah, near Johns Island, S. C., a freight train was derailed and the engineman, fireman and one brakeman were killed.

4th, 7 p. m., at the Union Station, St. Louis, Mo., an engine pulling a train of empty passenger cars into the station was derailed, and blocked several tracks. Eight trains in the station were delayed about three hours in getting out.

9th, on New York Central & Hudson River, at Bergen, N. Y., a freight train was derailed and the engineman was injured.

13th, 4 a. m., on Philadelphia & Reading, at Pottstown, Pa., a car in a freight train was derailed and fell upon the adjoining main track, where it was struck by a milk train. The car was crushed and the milk train engine was badly damaged. Three trainmen were injured.

22nd, on St. Louis, Iron Mountain & Southern, near Van Buren, Ark., a freight train was derailed and 20 cars were wrecked. A brakeman was killed.

23rd, on Southern Florida, at Istachatta, Fla., a freight train was derailed and several cars were wrecked. The conductor was fatally injured.

(*Continued on page 778.*)

The Drop Test as a Means of Showing Relative Strength of Draft Gears.*

BY R. P. C. SANDERSON.†

With the increasing weight and power of locomotives, double-head service, heavier trains and heavier cars, the draft rigging problem has forced itself more and more on our attention. Designs that for years have given good service and were, by the best authorities, looked upon as the most advanced practice, have failed utterly and miserably to meet modern service. The expense for maintenance of draft gears is becoming daily a larger factor in the total cost of car repairs, and something must be done to meet and better the conditions. Designs that stood well with trains of 2,000 tons, made up of 60,000 and 50,000-lbs. capacity cars, went to pieces when used in 80,000 and 100,000-lbs. capacity cars in trains of the same weight. When the time came for preparing designs for new cars, the draft gear proposition presented itself and had to be faced seriously. The arguments of the advocates of each draft rigging device presented for consideration were all very convincing as to the undoubted success of the advocate's own rigging, and at least suggested doubts as to the merits of the other fellow's gear. Faith being out of place, it was decided to test them all and trust to the survival of the fittest.

Having reached the conclusion that in modern train service the train shocks were of such momentum as to be quite beyond the power of any reasonable springs to absorb (and assuming we had spring capacity to do this, the recoil would itself cause break-in-twos), the malleable iron dead block becomes a necessity to protect the couplers. There is trouble enough with the M. C. B. coupler to-day without making it act as a collision buffer. It is too expensive to be used to take up shocks that are beyond the capacity of the draft springs. With malleable iron dead blocks to protect the couplers and draft gear from being driven under the cars, and assuming that we can make the draft gear equally strong in both directions, it resulted that the tests most suitable for the occasion were jerk tests, or such as would correspond to the forces at work in freight trains that tear out the draft gears, not by steady pull of the engines but by jerks or train shocks. The decision was therefore reached to use the usual 1,640-lb. drop test, setting a pair of center sills upright on each side of the weight guide posts, and to these center sills, which were firmly supported on the foundation, were attached draft beams, just as they would be attached to the cars. The draft gears to be tested were attached to these in the usual way, but, instead of couplers, heavy forged loops were secured to the yokes or pockets. This was done to avoid any troubles or uncertainties that might be introduced by the breakage of the couplers. We were after the draft gears, not the couplers. In the eyes of these loops rested a heavy cross bar of forged iron, on the center of which the drop weight struck, and which transmitted the

RESULTS OF DROP TESTS OF DRAFT GEAR—ATCHISON, TOPEKA[illegible]

No.	Ft.	A	B	C	D	E
1	5	Springs.. No damage	No damage	No damage	No damage	No da[illegible]
2	5	Springs.. " "	Draft timber checked at D, Fig. 5.	" "	" "	"
3	5	Springs.. Draft timber cracked at A, Fig. 4.	(Springs closed solid)	" "	" "	"
4	10	Springs.. No change	No change	(Springs closed solid)	(Springs closed solid)	(Spri[illegible]d, sto[illegible]
5	10	Springs.. " "	" "	No damage	No damage	No da[illegible]
6	10	Springs.. " "	" "	" "	" "	"
7	10	Springs.. " "	" "	" "	" "	"
8	10	Springs.. Another draft timber cracked at A, Fig. 4.	" "	" "	" "	"
9	10	Springs.. No change	" "	" "	" "	"
10	10	Springs.. " "	" "	" "	" "	"
11	10	Springs.. " "	" "	" "	" "	Pock[illegible] sheared
12	10	Springs.. " "	" "	" "	" "	" "
13	10	Springs.. Side casting cracked at B, Fig. 4.	" "	" "	" "	No d[illegible]
14	5	Blocks... No change	" "	" "	Stirrup cracked at eye	"
15	5	Blocks... First draft timber cracked further	" "	" "	Stirrup broke (replaced)	"
16	5	Blocks... Third draft timber cracked at A	" "	" "	No change	"
17	10	Blocks... No change	" "	Pocket cracked	" "	"
18	10	Blocks... " "	" "	Pocket broke and bolts sheared (repl'd)	" "	"
19	10	Blocks... " "	Pocket cracked at lip	No change	" "	"
20	10	Blocks... " "	No change	Pocket bolts sheared (replaced)	" "	"
21	10	Blocks... " "	Two draft timbers cracked	" " " "	Equalizer cracked	One [illegible]mber br[illegible]
22	10	Blocks... " "	No change	No change	Equalizer broke (replaced)	No c[illegible]
23	10	Blocks... " "	First draft timber broke at D, Fig. 5.	Pocket bolts sheared (replaced)	No change	Pock[illegible] sheared
24	10	Blocks... Two other side castings cracked at B.	Pocket broke in corner (replaced)	" " " "	" "	No c[illegible]
25	10	Blocks... No change	No change	" " " "	" "	"
26	10	Blocks... " "	" "	No change	Pocket bolt began to shear (replaced)	"
27	10	Springs.. " "	Head on center block rivet torn off	" "	No change	(Bro[illegible]t timb[illegible]
28	11	Springs.. " "	No change	" "	One pocket bolt sheared (replaced)	No c[illegible]
29	12	Springs.. " "	" "	" "	No change	Anot[illegible]t t'ber
30	13	Springs.. " "	" "	" "	" "	No c[illegible]
31	14	Springs.. Fourth draft timber broke at C	" "	" "	" "	"
32	15	Springs.. No change	" "	" "	" "	"
33	16	Springs.. " "	" "	" "	One pocket lip cracked	"
34	17	Springs.. " "	" "	" "	No change	"
35	18	Springs.. " "	" "	" "	One pocket lip cracked further	"
36	19	Springs.. " "	Pocket bolt head torn off	" "	No change	"
37	20	Springs.. " "	No change	" "	One pocket bolt sheared (replaced)	"
38	20	Springs.. " "	" "	" "	Another pocket bolt sheared (replaced)	"
39	20	Springs.. " "	Pocket lip cracked	" "	Another pocket bolt sheared	"
Observations after test			One follower bent ¼ in.	One center block rivet bent ¼ in.; One follower bent 3-16 in.; another ⅛ in.	One center block cracked at rivet hole and rivet bent ⅛ in. Same rivet on opposite draft rigging bent 1-16 in. One follower bent 5-16 in.; another ⅛ in. One side casting cracked through flaw in corner at E, Fig. 6.	Br[illegible]gh side [illegible]k in ca

(Note:—B and E. same make. C and D same make. G, H and I same make. Westinghouse friction draft gear not among those shown in table.—Editor.)

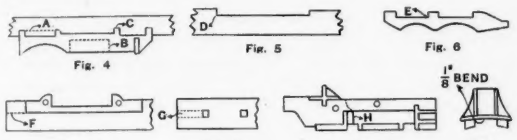
*Extracts from a paper before the Western Railway Club, November, 1900.

†Assistant Superintendent of Machinery, Atchison, Topeka & Santa Fe.

jerk blow to each draft gear equally. Here let it be said for the benefit of those who have not tried it, that the cross bar, as shown or indicated in the M. C. B. jerk test apparatus, is utterly inadequate for such tests as will be described in the following.

There are a few points which developed during the tests that do not refer to any particular draft gear, but which are of importance, that should be referred to before taking up tests of the different gears.

1st. The lug or turndown lip of the yoke or pocket to grip the shoulder of the coupler, is an absolute necessity. This was demonstrated by the fact that set after set of



Illustrating A., T. & S. F. Draft-Gear Drop Tests.

bolts sheared off, blow after blow, when the pocket strap was not lipped over, but depended entirely on the strength of the bolts or rivets. Further, even when so lipped over, there was a continual tendency of the ends to open and pull off the shoulders, stretching the end bolt at every heavy blow.

2nd. The breakage of the yokes not only in the corners and through the bolt holes but also at the sides through the solid iron, demonstrated that nothing less than good iron 1⅛ x 4 in. should be used with large radius and easy bends at the back corners.

To have a basis to draw comparison with, the first tests were made with a single spring pocket draft gear of ordinary style, but having heavy malleable iron cheek plates very securely fastened to the draft timbers, and having lugs bearing against the end sills, the back of them being supported by an oak block bolted between the center sills. While this gear is giving very good service in heavy trains with cars of 60,000 lbs. capacity and under, it is not believed to be strong enough to absorb the impact and momentum jerks produced by cars of 80,000 and 100,000 lbs. capacity. This single spring gear tested for comparative purposes is referred to under column A.

B—Is a tandem spring gear with short malleable cheek plates well secured to the draft timbers by bolts and gained into the timbers.

C—Is a similar one, but with larger and heavier cheek plates bearing against the end sills and center filling blocks.

D—Is a similar tandem gear, but having cheek plates of intermediate weight and strength between B and C.

E—Is a tandem spring encased gear, all malleable iron except for one follower, well secured to the draft timbers by bolts and gains.

F—Is a tandem spring gear, all malleable iron and encased, well secured to the draft timbers by bolts and gains.

G—Is a twin spring gear, entirely of malleable iron, the cheek plates being well secured to the draft timbers, and having the additional security of key-blocks to transmit the strains between the followers, cheek plates and draft timbers.

H—Is a similar twin spring gear, entirely of malleable iron, but the cheek plates are more of a box pattern and partly recessed into the timbers, delivering end thrusts onto the end grain of the wood.

I—Is a similar twin spring gear, but having malleable draft beams instead of draft timbers, the cheek plates forming part of the malleable draft beams.

The testing was done under the direct supervision of Mr. E. Grafstrom, Mechanical Engineer of the Atchison, Topeka & Santa Fe, and was watched by the representatives of the different gears. As there was no precedent to follow and nothing with which to compare these tests, it was thought best to commence with the M. C. B. jerk test for couplers, 3 blows at 5 ft., then 5 blows at 10 ft. The draft gear should certainly be stronger than the coupler. As no results of any consequence were reached with this, 5 more blows at 10 ft. were added. It was evident at this stage that it would take an endless number of such blows to break up some of the gears under test. The cushioning action of the springs, even though they went solid at 5-ft. blows, so mitigated the shock that it was decided to remove the springs and substitute hollow metal cylinders, repeating the test with these in place of the springs. We were searching for the weak places in the gears, and not testing springs. The blows struck in this series were very wicked, ugly jolts, but even after the series was completed still further tests were needed to enable us to reach results. It was then decided to replace the springs, as the drop testing machine itself required a little cushioning, and blows were struck commencing at 10 ft. and raising the drop 1 ft. per blow, up to 20 ft., at which height 3 blows were struck.

It may be said that the results of the tests as given in the table are inconclusive, and that we should have gone on smashing at them until the one fittest survived. Perhaps; but it was plain that we were able to select three or four gears that were all probably stronger than the framework of the cars; anyhow, they were a long advance on what had been used before, and it left the field open to the purchasing department to get rival bids from several firms, whose product had stood a most severe test successfully. It was further evident, that, even had we gone on to the utter destruction of each gear tested, still this would have settled nothing, even for a short time, because each maker would have immediately strengthened up his gear where it showed weakness and justly claimed that the test made should not condemn his revised design.

D'EK ANTA FE RAILWAY.

	E	F	G	H	I
No da	No damage	No damage	No damage	No damage	
(Spri ed, stops touched)	(Stops touched, but springs not closed).	(Springs closed, stops touched).	(Springs closed, stops touched)	(Springs closed, stops touched)	
No da	No damage	No damage	No damage	No damage	
Pock sheared (replaced)					
	Side castings began to crush timbers.	Pocket cracked			
	One side casting commenced to bend.	No change			
	Two other side castings bent	One draft timber cracked at G, Fig. 8.			
One mber broke at F, Fig. 7	No change	Same timber split more	Pocket broke, one side plate cracked at H, Fig. 9		
No c		Split section moved down ⅛ in.	No change		
Pock sheared (replaced)	One side c'st'g and 1 spr'g casingbroke.	Pocket cracked	Crack in side plate opened further	Pocket bolts began to shear	
No c	No change	Draft timber split further	Side plate broken in two	Pocket bolts sheared off (replaced)	
		Split section moved down further	No change		
	Dr'ft rig'ng d'm'g'd too much to pr'c'd.	Split sect'n mov'd further (timber repl.)	Rem'ing three side plates crack'd at H.	Pocket bolts sheared, one stop bar bent	
(Bro ft timber replaced)		Another d'ft timb'r began to split at G.	No change	No change	
No c		No change			
Anot ft t'ber began to crack at F					
No c		The third draft timber split at G			
		No change	Cracks opened further		
			No change		
			One stop bar bent		
		Third draft timber split more	No change		
		No change			
		Split section at G moved uown ⅛ in.			
		No change			
Br gh side casting bent, so ck in castings.		One stop bar bent slightly.	Besides the broken sill plate, the other three had cracked half way through.	One follower bent ⅛ in.; another 1-16 in. (Fig. 10); three mall. iron beams slightly cracked through flaws in angles.	

Friction Draft-Gear and M. C. B. Couplers in a Steel Car Collision.

On Oct. 14, 1900, between 11:00 and 11:30 p. m., a collision occurred under the following circumstances in the Anaconda yard of the Butte, Anaconda & Pacific Ry.:

Switch engine No. 3 was coupled to seven loaded pressed-steel ore cars at the east end of the yard, being on a side track. A man had been left to open the west switch, and, under the assumption that the track was clear the engineer was given a signal to come ahead (west), pushing the cars. Twenty-nine similar cars (loaded) were at the other end of the siding, about three-quarters of a mile from where the seven were coupled to. As a result, a collision followed. No time for warning was had, and the seven cars and engine were moving at about 13 miles an hour with the latter working steam. Under ordinary circumstances, the air-brakes would have been set on the 29 cars, and it is, therefore, assumed that such was a fact, though the number of cars showing evidence of having received a very severe shock gives rise to some doubt on this point.

The resultant injury to equipment consisted of the colliding ends of the two cars being considerably damaged, the worst damage being on the seventh, or last, car from the engine. The damage to the other car was so much less as to enable it being readily repaired by straightening the longitudinal sills and applying a new end sill. To facilitate this work (as repair material had to be ordered from Pittsburgh), the end sill was removed from the car. At the colliding ends, one coupler was broken in the shank, close to the head, and the other had the guard-arm broken off. The coupler was the "Standard," with solid knuckle.

All of the cars were fitted with the Westinghouse friction draft gear; not one of which attachments, even on the colliding cars, was damaged in the least.

The opposite from the colliding ends of the two cars mentioned had slight kinks in the center sills, near the body bolster, the striking plate and end sill were bent in about 7-16 in. just back of the coupler head, and the coupler locking pin was wedged from the blow received through the knuckle of the opposite coupler. In 29 cars, 37 locking pins were so wedged. These were driven out, slightly ground, and returned to their couplers. About 20 cars had the center sills injured as described, but in no instance was the damage sufficient to require any repairs.

The average load of these ore cars is 110,000 lbs., their light weight is 34,800 lbs., and the engine, with tender, weighed about 150,000 lbs. For the engine and seven cars this makes a total of 1,163,600 lbs. At 13 miles per hour, and neglecting the effect of the steam being used, this represents a striking force of 6,575,000 foot-pounds, which is equivalent to the blow one of these 110,000-lb.-capacity steel cars, fully loaded, and weighing 72½ tons, would strike if dropped freely from a height of 54 ft. Even though no brakes were set on the 29 standing cars, yet their great weight and small amount of slack between them insure that the enormous energy in engine and seven cars moving must have been dissipated in an exceedingly short distance.

That this was followed by such comparatively slight damage is a splendid tribute to the Westinghouse friction draft gear, to which Master Mechanic A. Harrity gives unbounded praise. While reducing greatly the consequent damage, it came out unharmed.

Nor should the strength of the car or coupler pass unnoticed, though the weakest points in each, under buffing shocks, were demonstrated to be as described. The coupler has a 6-in. shank, in this being out of the ordinary.

RAILROAD GAZETTE

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EDITORIAL ANNOUNCEMENTS.

CONTRIBUTIONS—Subscribers and others will materially assist us in making our news accurate and complete if they will send us early information of events which take place under their observation, such as changes in railroad officers, organizations and changes of companies in their management, particulars as to the business of the letting, progress and completion of contracts for new works or important improvements of old ones, experiments in the construction of roads and machinery and railroads, and suggestions as to its improvement. Discussion of subjects pertaining to ALL DEPARTMENTS *of railroad business by men practically acquainted with them are especially desired. Officers will oblige us by forwarding early copies of notices of meetings, elections, appointments, and especially annual reports, some notice of all of which will be published.*

ADVERTISEMENTS—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and these only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially either for money or in consideration of advertising patronage.*

In nine years from 1890 to 1899, the mileage of railroad reporting to the United States Inter-Commerce Commission increased from 163,597 miles to 189,295, or 15.7 per cent., and in that period the mileage of second track and sidings increased from 35,255 to 49,685 miles, or 41 per cent. In times of very active railroad construction the proportion of second track and sidings is likely to decrease rather than increase, because new road usually needs to be prepared only for a light traffic. In the first four years of this nine-year period, ending with 1894, the mileage of road increased 9¼ per cent., the mileage of sidings, etc., 21 per cent.; in the last five years the mileage of road increased less than 6 per cent., the mileage of supplementary tracks 16 per cent. Thus the roads have been providing rapidly for an increasing density of traffic, in two ways, by increasing supplementary tracks which enable them to run more trains; and, to a still greater extent, by increasing the capacity of cars and locomotives, so that the same number of trains carries much more freight.

Doubtless a number of our readers will be interested in, as well as instructed by, what Mr. Dickie says about marine engines in his article on competition in shipbuilding. He says that while we compete with engine builders in Great Britain in land engines we cannot compete with them in marine engines on present methods, and to do so we must be content without the professional luxury of introducing some engineering novelty with every ship we engine. He found there in a great marine engine works that the term erection was not used. Every part is finished to gage and is carefully examined and if defective sent back to the workman. The parts are not erected, but put in stock ready to be assembled in a few hours. Such a system would, he thinks, reduce the cost of erection by half, besides producing a number of other results which he points out in the article. Doubtless this will be quite surprising to a good many people, for we have got in the habit of thinking that we beat the Englishmen on just this sort of shop management. In all of the discussions which attempt to account for our success in getting foreign trade we find it taken for granted that we get along with less hand fitting in the assembling of parts supposed to be finished. There are several other matters mentioned in Mr. Dickie's paper which will have somewhat useful results in tending to take the conceit out of us. Probably the most dangerous gift that the Englishman has is his self-complacency, and we as descendants of the same race are not without that quality, and the man who disturbs our self-complacency does us a real service.

On another page is a short summary of some of the present political conditions surrounding the question of isthmian canals. The policy of the journal from which we quote is what many well meaning people and many designing people who are not well meaning call "Americanism." Such people start with the proposition that only one canal is to be considered, the Nicaragua, and go on to the other proposition that the United States must own, fortify and control this canal, irrespective of all other nations of the earth. Our readers need not be told that we suspend opinion as to the first proposition and are entirely opposed to the second. The Isthmian Canal Commission may report in favor of the Nicaragua route or it may report in favor of Panama, and whichever way it reports Congress should be guided by the recommendations of that Commission. The gentlemen composing it have been able to attack the subject with more accumulated knowledge and more money than any other group or commission that has ever reported on this matter for our government. The majority of them are men without prejudice one way or the other, and of unusual ability and experience. If professional authority is ever to be respected it should be in this case. We have not sought to ascertain what the report of this commission will be, for we consider that it would be highly improper to do so. We should not be at all surprised, however, if the balance of opinion as expressed in the report is found to be in favor of the Panama route, although it is quite possible that the owners of the new Panama Canal Company will want an unreasonable sum for their equity, and it is quite possible that the concessions are too onerous to be assumed by any company or nation. On the other hand, it seems quite probable that the limit of the cost of the canal as laid down in the Hepburn bill, namely, $140,000,000, is too low, but in any case the proposition that the United States should fortify the canal and control it without the co-operation of other nations seems fallacious. It amounts to assuming the protection of a piece of coast line far away from our proper shores. Such control would be ineffective without heavy fortifications, considerable garrisons and a much greater navy than we have now or are likely to have for many years to come. If the nations of the earth do not agree to guarantee the neutrality of the canal it will be seized in case of war by the power which can get there first with the strongest force, and that power might or might not be the United States. Therefore, the whole theory of making it a strictly American canal falls to the ground, so far as military purposes are concerned, unless we are prepared to spend great sums of money in protecting it through years of peace in order to be ready for some remote but possible war. Furthermore, as a trade route the only possible hope that the canal will come near earning working expenses and a small interest on the investment rests upon its being equally available for trade to the ships of all nations.

Relations of Freight Traffic and Rolling Stock.

The sudden and great revival of freight traffic after the fiscal year ending with June, 1897, we have heretofore remarked, in connection with the Interstate Commerce Statistics for 1898. This showed an increase in one year of 20 per cent., which, in a country where the yearly increase in population is less than 2 per cent., indicates an extraordinary increase in industrial activity. Now the statistics for 1899 have appeared, showing a further increase of 8½ per cent. —small in comparison with the previous year, but absolutely very great. In the first of these two years the increase was chiefly due to the resumption of production by mines, manufactories, etc., which had been closed or not worked to their full capacity; but in the following year (1898-99), the gain must have come chiefly from new or enlarged enterprises. The freight traffic for the last six years (ending with June) has been in *millions* of ton-miles:

1894.	1895.	1896.	1897.	1898.	1899.
80,335	85,226	95,328	95,139	114,078	123,667

The traffic in 1894 was 14 per cent. less than in 1893, and the lightest for four years; but there was a quick recovery; and in 1899 the increase over 1894 was 43,332 millions of ton-miles, or 52 per cent. Perhaps we may better appreciate this five-years' growth of traffic when we know that it is more than the total freight transportation of France, Germany, Austria and Hungary combined, in the last year reported. The gain in the last two years alone is 30 per cent.

Now this great increase of 30 per cent. in freight traffic in two years was made with an increase of only 1.6 per cent. in the number of freight locomotives, and of only 6 per cent. in the number of freight cars; and since 1894, for the increase of 52 per cent. in freight traffic, there has been an increase of but 7½ per cent. in the number of freight cars, and of 3⅝ per cent. in the number of freight engines. Of course this does not begin to represent the increase in the capacity of the rolling stock. Time was when a freight car was a freight car, and the variations from 10 tons' capacity were insignificant. That time is far behind us; the 10-ton cars are antiquities, in our country, and, further, there is great variation in the capacity of the cars now ordered, so that their number alone does not give a key to the capacity of the car stock; and the transformations from lighter to heavier have been especially numerous in the last few years, as for some time previous additions of any kind to equipment were few, for lack of traffic. But the final result is reflected best in the average freight train loads, which have been, in tons:

1894.	1895.	1896.	1897.	1898.	1899.
179.8	189.7	198.8	204.6	226.4	243.5

Thus the average train-load increased 35 per cent. in the last five years, and 19 per cent. in the last two years.

The Interstate Commerce Commission report shows the increase in average efficiency of cars and engines in a striking way, by giving the number of ton-miles per freight locomotive in successive years, to which we add the number per freight car. The comparison of 1894 with 1899 is as follows:

Ton miles.	1899.	1894.	Increase.	P. c.
Per freight engine.	5,966,193	4,016,755	1,949,438	48.6
Per freight car...	95,458	66,604	28,854	43.3

This is certainly a remarkable transformation to have been effected in so short a period.

October Accidents.

Our record of train accidents in October, given in this number, includes 126 collisions, 127 derailments and 4 other accidents, a total of 257 accidents, in which 74 persons were killed and 176 injured. The detailed list, printed on another page, contains accounts only of the more important of these accidents. All which caused no deaths or injuries to persons are omitted, except where the circumstances of the accident as reported make it of special interest.

These accidents are classified as follows:

Collisions.	Rear.	Butting.	Crossing and other.	Total.
Trains breaking in two	6	0	0	6
Misplaced switch	4	4	1	9
Failure to give or observe signal	6	2	8	16
Mistake in giving or understanding orders	1	4	2	7
Miscellaneous	10	3	18	31
Unexplained	22	12	23	57
Totals	49	25	52	126

Derailments.

Broken rail	2	Misplaced switch	4
Loose or spread rail	4	Track repairers	2
Defective bridge	4	Bad switching	4
Defective switch	2	Bad loading	4
Soft roadbed	2	Animals on track	7
Broken wheel	11	Landslide	5
Broken axle	3	Malicious obstruction	3
Broken truck	3	Accidental obstruction	3
Fallen brake-beam	1	Unexplained	58
Brake hose burst	4		
Failure of draw-bar	1	Total	127

Other Accidents.

Boiler explosion	1
Broken side rod	1
Cars burned while running	2
Total number of accidents	257

A general classification shows:

	Collisions.	Derailments.	Other accidents.	Total.	P.c.
Defects of road	0	14	0	14	6
Defects of equipment	6	23	2	31	11
Negligence in operating	63	14	2	79	31
Unforeseen obstructions	0	18	0	18	8
Unexplained	57	58	0	115	44
Totals	126	127	4	257	100

The casualties may be divided as follows:

	Collisions.	Derailments.	Other accidents.	Total.
Killed—				
Employees	24	31	1	56
Passengers	4	9	0	13
Others	2	3	0	5
Totals	30	43	1	74
Injured—				
Employees	68	44	4	116
Passengers	9	39	3	51
Others	4	5	0	9
Totals	81	88	7	176

The casualties to passengers and employees, when divided according to classes of causes, appear as follows:

	Pass. killed.	Pass. injured.	Emp. killed.	Emp. injured.
Defects of road	8	12	2	6
Defects of equipment	0	17	2	12
Negligence in operating	4	9	27	71
Unforeseen obstructions and maliciousness	0	7	15	18
Unexplained	1	6	10	9
Totals	13	51	56	116

Forty-six accidents caused the death of one or more persons each, and 55 caused injury but not death, leav-

ing 156 (61 per cent. of the whole) which caused no personal injury deemed worthy of record.

The comparison with October of the previous five years shows:

	1900.	1899.	1898.	1897.	1896.	1895.
Collisions	126	165	111	91	72	60
Derailments	127	121	105	68	62	64
Other accidents	4	6	1	6	7	7
Total accidents	257	292	217	165	141	131
Employees killed	56	26	33	25	27	40
Others killed	18	18	12	29	22	9
Employees injured	116	107	87	65	55	73
Others injured	60	61	23	51	34	100
Average per day:						
Accidents	8.29	9.42	7.00	5.32	4.55	4.19
Killed	2.39	1.42	1.45	1.74	1.58	1.52
Injured	5.68	5.42	3.55	3.74	2.87	4.94
Average per accident:						
Killed	0.29	0.15	0.21	0.33	0.35	0.36
Injured	0.68	0.58	0.51	0.70	0.63	1.18

The total number of accidents in October was not so large as in October a year ago, but the number of persons killed is unusually large. We rarely report so high a number, except when some great passenger-train disaster occurs. The number of employees killed, 56, has been equaled by only four monthly records during the past ten years.

The most serious passenger train accident, that at Dehart, Mont., on the 28th, is reported as due to a broken switch rod. The three men killed at Chatawa, Miss., were drovers, riding on a freight train.

The most peculiar freight train accident in the October record is the crossing collision at Springfield, Ill., on the 14th, where an engineman and a fireman ran their engine into a freight train, which was crossing their path, without either of them seeing it until it loomed up about 10 ft. in front of the pilot of their engine. The collision affords a simple but striking lesson concerning the value of fixed signals at crossings.

There was a butting collision at Stanstead Junction, Quebec, Oct. 3, in which two firemen and one passenger were killed or fatally injured and eight other persons were injured.

The street car accidents reported in the United States in October foot up 19, with two persons killed and 116 injured. Two of these accidents, due to unusual causes, have already been mentioned; one was a collision, at Chicago, due to a break-in-two, and the other was a butting collision due to the efforts of a motorman to make a meeting point by force; to crowd the opposing car back to the side track which it had last passed.

The Germans have been celebrating the 100th anniversary of the birth of Moltke, and in connection therewith it is shown that he had not a little to do with the development of the German railroad system. In 1841 he was made a director of the Berlin & Hamburg Railroad Company, whose road was then only a project, and he gave very serious attention to the undertaking. In 1843 he wrote an article on "Considerations Governing the Choice of the Route of a Railroad," which is said to show excellent judgment of the economic as well as the technical considerations to be taken into account, and to give a minute description of the locomotive such as would have done credit to an expert. He also appreciated the railroad as a freight carrier at a time when few in Continental Europe regarded it as of importance except for carrying passengers. After the war, which established his reputation and gave tremendous weight to his opinions on all subjects relating to the army, he did not neglect the economic side of railroad affairs, as is seen by his opposition in Parliament to a project for a new railroad which would compete with an existing line. "From a military standpoint," said the old general, "every railroad is welcome, and two railroads are better for us than one; but economic reasons are against building a road which is not necessary." He urged in favor of the union of railroads in a state system the greater simplicity in the dealings of the military, with the operating officers, and at the age of 91, shortly before his death, he urged with great earnestness the introduction of uniform standard time on the railroads throughout the Empire, which, but for him, perhaps, would have failed.

The report of the Manhattan Railway Co. for the year ending Sept. 30 was made public last week. The gross earnings amounted to $9,951,000, exceeding those of the year before by $625,000. The net earnings were $4,755,000, or $716,000 more than in 1899. Deducting interest and taxes the net income was $2,067,000, an increase of $745,000. Dividends to the amount of $1,920,000 were paid and the surplus to profit and loss was $4,310,000. The operating expenses, excluding taxes, were 52.21 per cent. of gross earnings, as compared with 56.69 the year before. Including taxes, a similar decrease was made. The number of passengers carried amounted to 183,789,000, the increase during the year having been 6,584,000. The road is not yet back to its high-water mark as regards the annual passenger trips, but it will be seen that the increase is substantial, and we should expect it to go on at a much faster rate when the electrical equipment is in operation. We may hear any day now of the trial of an experimental train for which power will be taken from the lines of the Metropolitan Street Railway Co. In an address at the annual meeting Mr. Gould said that the company's general improvements other than the change of motive power will begin to produce results soon.

In another column will be found an extract from a paper which describes a new piece of apparatus recently designed for testing the strength of materials when subjected to a suddenly applied load. The machine is of original design and has, we understand, proven its value in service. It was built in the mechanical laboratories of Purdue University, the work of construction being performed almost entirely by students in the shop laboratories, giving a class of work somewhat heavier than that ordinarily found in a college machine shop, where the practice too often involves a great number of small pieces made only as exercises.

NEW PUBLICATIONS.

A Manual of Explosives. A Brief Guide for the Use of Miners and Quarrymen. By Courtney DeKalb, Professor of Mining and Metallurgy in the School of Mining, Kingston, Ont. Toronto: The Ontario Bureau of Mines, 1900.

Prof. DeKalb has prepared, with the authorization of the Commissioner of Crown Lands, a little volume designed primarily to diminish the number of casualties arising from careless or ignorant use of explosives in mining. This is issued by the Bureau of Mines at Toronto for presentation to all mine managers in the Province as well as to foremen and others who have charge of operations with explosives. Copies can probably be had by addressing Archibald Blue, Esq., Bureau of Mines, Toronto, Ont. The first chapter deals with the composition and properties of common explosives, of which some 40 are mentioned. Another chapter deals with fuses, caps and methods of firing; another with the theory of explosives and fumes; another with transportation, storage and handling, and the last chapter with blasting. One appendix gives examples of causes of accidents, another one a list of important books on explosives and still another gives the regulations for the storage and handling of explosives in Ontario. The utility of the book is increased by a good index. Mr. DeKalb has had a wide practical experience besides his experience as a writer and teacher, and consequently he has been able to prepare a useful and concise manual which cannot fail to be of great value.

American Trade Index. A Descriptive and Classified Membership Directory of the National Association of Manufacturers of the United States, Published for the Convenience of Foreign Buyers. Philadelphia: National Association of Manufacturers, 1900.

The purpose of this Index is to furnish to merchants a comprehensive hand-book of the leading manufacturers of the United States. The volume contains the names of those members of the National Association of Manufacturers who make goods suitable for export and gives certain information concerning those goods. The Index is not sold, but is distributed gratuitously to foreign merchants of standing and responsiblity and is not intended for circulation in the United States. It contains an alphabetical list of members, in English and in French. These two lists fill about 400 pages. Then there is an alphabetical list of articles made by each house, also in English and French, occupying 240 pages. Another list is the registered cable addresses of members; then follow a few pages of advertisements. The volume is excellently printed, the name of each house being in simple and bold type and this is followed by a brief sketch of the materials made by each house.

TRADE CATALOGUES.

The Union Station at Omaha is the subject of a handsome pamphlet which has been issued by the Passenger Department of the Union Pacific. The frontispiece is an excellent photogravure of Omaha, taken from an elevated point northwest of the central portion of the city. The pictures describing the station, which are to be found on every page, consist of direct process engravings, made from photographs, and they are very effective and unusually complete, every feature of the station being shown, including the interiors of the ticket office and baggage room. Every picture, however, is confined to a detail, so that the reader does not get a comprehensive idea of the station until he reaches the diagrams, which are on folded insets following the last page. The text appears to have been prepared with much care, but it is somewhat florid. The Union Station, which fronts on South Tenth street, is used by all of the roads entering Omaha, except the Burlington, the Elkhorn, and the Chicago, St. Paul, Minneapolis & Omaha.

Steel Plate Fans.—The B. F. Sturtevant Co.'s catalogue No. 96 is now out, third edition. It treats exclusively of steel plate fans for general use in ventilation, heating, and mechanical draft, where large volumes of air are to be moved without great speed or pressure. Numerous types of belted or direct steam engine-driven and electric motor-driven fans are illustrated. On pages 92 and 93 are illustrations of an induced-draft steam fan plant in connection with heat abstractors, and a simple induced-draft plant. Page 94 illustrates an induced-draft plant with an economizer. Page 95 shows a forced draft plant with direct connected horizontal steam engine. The space given to electrically-driven fans, and instruments for testing fan systems, contains much information on mechanical draft, and the tables that follow are well adapted to the subject in hand. There is more detailed information condensed there than is commonly available without search of text-books.

Heating, Ventilating and Moistening.—"The Sturtevant System of Heating, Ventilating and Moistening Textile Manufactories" is the title of catalogue No. 66, fourth edition, B. F. Sturtevant Co., Boston, Mass. The catalogue contains an argument for the joint treatment of the three considerations named, and emphasizes the unsatisfactory results of treating heat, humidity, and ventilation separately; or with no particular attention to the atmospheric condition as a whole, especially where a fixed normal condition is desirable, as in textile manufactories. The Sturtevant system of nesting steam pipes in a single coil at the air intake of a building and in the direct path of fresh air drawn in and distributed through ducts, is described and its advantages emphasized. There are tables and statements of comparative cost; a variety of illustrations of apparatus in detail; and architectural drawings showing installations under various conditions.

Pneumatic Tools.—The Cleveland Pneumatic Tool Co., 74 Frankfort street, Cleveland, Ohio, has issued a catalogue of 31 pages with photographs and sectional drawings of their pneumatic drills and hammers. There is a liberal amount of condensed data on weights of tools, and feet of free air used for given duty. Riveting and heavy chipping hammers are special features; also piston air drills. There are instructions for the care and operation of the tools and many illustrations of structural and general shop work. The tools are sent on trial when desired, and the catalogue gives a clear idea of what may be expected from their use.

Edison-Lalande Batteries.—This is the title of a pamphlet which has been issued by the Edison Mfg. Co., 135 Fifth avenue, New York City, describing the company's batteries "R R" and "S S" for automatic block signals and highway crossing signals. Both these types have a capacity of 300 ampere hours, and the pamphlet says that they will stand a continued temperature of 20 deg. below zero without freezing. Illustrations are given showing signals made by the Union, the Hall, the Standard and the Sargent Signal Companies, and of the American, the Chicago, the Three Rivers and the S. & R. highway crossing signals.

Pipe and Boiler Coverings.—A small catalogue, issued by the H. W. Johns Mfg. Co., 100 William street, New York, called "Something About Coverings," contains information on heat insulation by the use of different coverings. It is illustrated with views of various applications of insulating materials and shows also the survival of pipe covering in the great oil fire at the Bayonne, N. J., works of the Standard Oil Company. The record of this severe test and the tables of data from several practical tests are of value.

American Practice in Block Signaling.*

BY B. B. ADAMS.

X.

AUTOMATIC BLOCK SIGNALS—CONTINUED.

No new clock work signals have been put up since 1894, as other kinds have been found more desirable. The enclosed disk signal, first extensively used by Hall, was early in the field, but until about 1890 it was used only with wire-circuits. The track-circuit was from the first in great favor because, aside from its other merits, it usually detected broken rails, and because its efficiency was never impaired or interfered with by the accidental breaking apart of a train. The electro-pneumatic system was brought out soon after the clock-work, but its progress was slower because of its greater cost. The most extensive installations of clock-work signals are those of the Boston & Albany, the Old Colony (New York, New Haven & Hartford) and the Boston & Maine. On each of these roads large numbers of these signals have been in use 10 or 15 years and more. The regulations for their use are quite simple. The essential clauses of the Boston & Albany regulations are as follows:

When the number has been placed on an automatic signal, it denotes that it has been put in operation, and should be observed under the rules.

Enginemen should notice that an automatic signal changes to danger when a train approaches within 200 ft. of an all-clear signal.

When a train finds an automatic signal at danger (that is, showing a red target or light), or if an all-clear signal fails to change to danger, its speed will be reduced to three (3) miles per hour, and [it will] proceed only as the way is known to be clear; but the signal must be reported as if causing a stop. If the number of an automatic signal is covered or erased, enginemen will proceed with caution through the section to which that signal applies.

A train need not stop at a signal which is not lighted; but it must be reported, unless the number is covered or erased.

Enginemen must report all stops on the proper blanks.

It will be observed that the Boston & Albany sets the signals 200 ft. in advance of the entrance of a block-section. This is to enable each engineman to know positively that the signal is in working order and has moved to the stop position, so as to protect his train. This 200-ft. arrangement is not universal with automatic signals. It is objectionable, at least theoretically, to have enginemen run past a signal which is in, or is moving toward, the stop position. Again, a signal migh be moving to the stop position, just a second or two before the engine

*Previous articles of this series may be found on pages 4, 34, 83, 121, 161, 222, 565, 734, 753.

wheels entered the section, by reason of the misplacement of a switch; and the engineman would think that the movement was caused by his own engine. On the other hand, if the signal is arranged to move to the stop position after the engine has passed it, there is no check on its operation. A signal might be out of order and stand continually in the all-clear position and the engineman never know it. To have a brakeman or flagman on the rear end of the train watch the signals and record their movements is attended with some difficulty and has never been systematically undertaken. On railroads where the signals move to the stop position behind the engine, the officers assert that the design and construction of the signals and the efficiency of the care and inspection warrant the assumption that dangerous failures—failure of the signal to go to "stop" when a train enters the section—will not occur. The "normal-danger" arrangement, hereafter to be described, obviates some of the objections to setting the signal behind the engine.

It was formerly customary to require trains to be brought to a stop on encountering a signal showing red, or not in working order; but with suitable discipline the present Boston & Albany rule is found satisfactory. The same rule prevails on the Central of New Jersey, where automatic block signals of another kind are used. On the Lehigh Valley and the Pennsylvania the rule requires a train to stop one minute, and then proceed, expecting to find an obstruction. These three roads, unlike the Boston & Albany, have distant as well as home signals in their automatic systems.

Enginemen's reports of stops, are, of course, promptly examined and if found to indicate any defect or derangement of signals are at once attended to by an inspector.

Trouble is sometimes experienced by using hand cars on tracks connected with clock-work signals, because the hand car sometimes does not make a thoroughly good connection between the rails, and the signal operates to show danger or safety according as the circuit is repeatedly completed or broken by the hand car, and the clock work is entirely run down; it may happen therefore that the signal requires to be wound several times a day in order to keep it in service. This can be prevented, of course by using hand cars with wooden wheel centers, but then the signal would never be operated by hand cars, and if one should be left on the track the signal would not give warning to trains.

The efficiency and reliability of automatic signals depends on constant and intelligent inspection and care. The number of failures of clock-work signals is ordinarily but a very small fraction of 1 per cent. of the number of operations, but nevertheless is probably larger than from other forms of automatic signals. A variety of causes may make the signal show "stop" when no train is in the block. A broken rail, a broken wire above or below ground, a bad connection or a broken spring in the switchbox, failure of the battery or of the relays, or the breaking of a battery jar; also, since the rails require to be bonded with a wire past the joints, a failure may be caused by a broken wire, or by rust in the holes in the rails; cinders on the track may also cause so great a leakage of current as to make the signals inoperative. Breakage of battery jars has been a great source of trouble, but this can be almost entirely done away with by using first-class material for these jars.

The worst failures of an automatic signal are, of course, cases where the signal should show "stop" but is actually standing clear. These are very rare and the record is constantly becoming better in this respect. The principal causes are lightning (in the summer), sleet storms (in the winter), fixed magnetism in the relay or the signal magnets, or the sticking or binding of some part of the clock work. Better mechanical work will eliminate most of the failures of the clock work; such as remain being due to causes inherent in the principle, and only to be gotten rid of by abandoning the clock work altogether. A heavy rain in winter turning quickly to snow or sleet will sometimes stick all the clock-work signals in the position in which they happen then to be, and they will not work again until set free by breaking away the ice or by moderation of the temperature.

THE ENCLOSED DISK SIGNAL.

The distinctive merit of this signal is that the moving parts are protected from wind, rain, snow and ice, and therefore can be made light enough to be moved by an electro-magnet of moderate size. Thus the use of a more powerful force, such as the weight and clock-work, is unnecessary. The signals of this type, made by the Hall Signal Co., are constructed on the same general principle as those used by that company at first with wire circuits. The arrangement of circuits shown in connection with the clockwork signal (Figs. 26 and 27) is applicable to all automatic signals. The outward appearance of a wooden case for an enclosed signal is shown in Fig. 28. The case is supported on a post of suitable height, or on a bridge, and is usually painted a dark color. Metal cases are also used. The disk, about 18 in. in diameter, made of silk or other light fabric, stretched on a metal ring, or of aluminum, very thin, is fixed to the armature of an electro-magnet in the way shown in Fig. 29. When the block-section is clear and the signal magnet is consequently energized, the armature holds the disk up, in the position shown at the left of Fig. 29; and the approaching engineman, looking at the glass-covered opening, sees the back of the interior of the case, which is painted white; this is the all-clear signal. On the withdrawal of the electric current the disk drops by gravity to a position before the window (the armature and rod turning on the axis as shown), thus displaying a red, or stop, signal. For a distant signal a green disk is used. In the older style of signal the night signal is a lamp fixed at the back of the disk, outside case, showing uncolored for all-clear and illuminating the cloth disk for the opposite indication. In the later designs the lamp is placed back of the smaller opening near the top of the case, and the upper end of the rod which carries the cloth disk (See Fig. 29) has

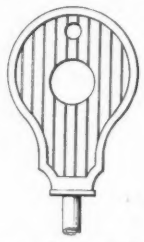


Fig. 28.—Case for Enclosed Disk Signal.

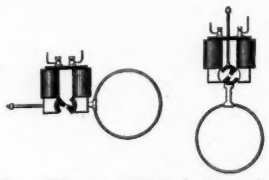


Fig. 29.—Hall Automatic Signal Magnet.

fixed to it a small transparent disk, colored to correspond to the color of the day disk.

Enclosed signals may become obscured by damp snow sticking to the outside of the glass, and sometimes the rays of the sun, or light reflected from the sky, will make it impossible to see the color of the signal promptly on approaching it. These difficulties may cause delay to trains, but they cannot be called elements of danger, as a signal imperfectly displayed must, according to the rules, be regarded as a stop signal. The officers of the railroads using these signals do not seem to consider these delays as very serious.

The First Stone Arch Bridge Built in the United States.

The first stone bridge with ring stones built in the United States is claimed by the town of Ipswich, Mass. This bridge, while not of great magnitude, consisting of two spans of about 28 ft. each, has an interesting history and reflects no little credit upon its builder.

The structure is situated upon South Main street, where it crosses the Ipswich River. The sidewalk is about 6 ft. wide and the roadway 22 ft., one side of which is occupied by a single trolley car track. In 1838 the bridge was widened 12 ft., making the original width between parapets about 16 ft. The material is granite hewn or split from boulders collected from the fields nearby. The inscription cut in a large stone at one end of the sidewalk parapet reads, "Choate Bridge. Built by Town and County, 1764."

Col. John Choate, the builder, must have possessed considerable courage to attempt such a structure, for, like all innovations, it was ridiculed by many from the start. When the time drew near for the falsework to be removed public opinion ran so high against the bridge, which was deemed unsafe by a large number of the citizens, and by some even it was contended that it would not stand under its own weight) that Col. Choate, to save his life in case the bridge failed, had his horse ready to take him out of the district. His precautions were needless, however, as the bridge did not fall and has been in constant use up to the present time. It trembles a little under a heavy team, but will doubtless give good service for many years to come.

Much of the above information has been verified through the courtesy of Mr. Charles W. Bamford, Town Clerk of Ipswich. One of the most interesting things concerning the town which the writer learned from Mr. Bamford was that, according to the Town records Ipswich claims to be the "Birthplace of American Independence," as shown by the following vote passed at Ipswitch Town meeting, Aug. 23, 1687, in controversy to a tax levy:

"Then considering that the s'd act doth infringe their Liberty as Free borne subjects of his Majestie by interfearing with ye statutory Laws of the Land. By which it is enacted that no taxes shall be levied on ye Subjects without consent of an assembly chosen by ye Freeholders for assessing the same: They do therefore vote, that they are not willing to choose a Commissioner for such an end, without said priviledges, and moreover consent not that the Selectmen do proceed to lay any such rate, until it be appointed by a General Assembly, concuring with ye Governor and Counsell."

For this vote the participants were promptly fined and imprisoned. M. A. H.

The First Stone Arch Bridge in the United States.

Train Accidents in the United States in October.

(*Continued from page 774.*)

24th, on International & Great Northern, near Thorndale, Tex., a freight train was derailed and a brakeman was injured.

24th, on Pennsylvania road, at 38th street, Philadelphia, a freight engine running backwards was derailed, and the conductor and one brakeman riding on the tender were killed. Another trainman was injured.

24th, on New York Central & Hudson River, at Clearwater, N. Y., a freight train was derailed, wrecking several cars; the fireman was killed and one brakeman injured.

25th, on Seaboard Air Line, at McKenney, Va., a freight train was derailed and six cars were wrecked; one man was injured.

26th, on Denver & Rio Grande, at Spike Buck, Colo., a freight train was derailed and 10 cars fell into the river. The fireman was fatally injured.

29th, on Missouri, Kansas & Texas, at Cat Springs, Tex., a freight train was derailed and the conductor was injured.

And 43 others on 28 roads, involving 2 passenger and 41 freight and other trains.

OTHER ACCIDENTS.

12th, on Chicago & Alton, near Curryville, Mo., the locomotive of passenger train No. 49 was wrecked by the explosion of its boiler. A porter was killed and the engineman, fireman and three passengers were injured. The engine and first three cars were ditched and wrecked.

21st, on Seaboard Air Line, at Hardaway, Ala., the locomotive of a passenger train was badly damaged by the breaking of a driving rod and the engineman and fireman were injured.

And 2 others involving 1 passenger train and 1 freight.

A summary will be found in another column.

The Society of Naval Architects and Marine Engineers.

On Thursday and Friday of last week the eighth annual convention of the Society of Naval Architects and Marine Engineers was held in New York City at the House of the American Society of Mechanical Engineers, closing with a banquet Friday evening at Delmonico's. There was a good attendance of members and guests, including a number of distinguished foreigners. The President, Mr. Clement A. Griscom, was in the chair at the opening meeting and made a short address. He said that during the fiscal year ending June 30 eighty steel steamships were built in the United States of 168,000 gross tons. In the same year Great Britain built 567 steel steamships of 1,341,000 gross tons. Nearly all of our shipyards have been busy and every large plant has increased its capacity; and several new yards have been established. The keels of two of the largest steamships ever built will soon be laid at New London, Conn. Mr. Griscom referred of course to the ships to be built for the Great Northern Railway. Since the fiscal year ended, ships have been launched, begun or contracted for to the number of 78, of 350,000 gross tons. These include 10 ocean steamships each of 10,000 gross tons or more.

The report of the Secretary-Treasurer showed a membership in all classes of 669, a net gain for the year of 96. The expenditures amounted to about $5,000. The Association has $1,700 cash on hand and $3,000 invested.

The Nominating Committee recommended the re-elec-

tion of the officers of last year with the addition of Mr. Walter A. Post. The officers elected are therefore:

President, Clement A. Griscom.

Vice-Presidents, Francis M. Bunce, Charles H. Cramp, Frank L. Fernald, Philip Hichborn, Charles H. Loring, George W. Melville, George W. Quintard, William T. Sampson, Irving M. Scott, and Edwin A. Stevens.

Members of Council, W. Irving Babcock, Francis T. Bowles, Washington L. Capps, French E. Chadwick, James E. Denton, George W. Dickie, William F. Durand, Edward Farmer, H. T. Ganse, Nathaniel G. Herreshoff, William H. Jacques, George E. Weed, John C. Kafer, Frank B. Kling, Frank E. Kieley, Walter M. McFarland, Jacob W. Miller, Lewis Nixon, Cecil H. Peabody, Walter A. Post, Harrington Putnam, Horace See, E. Platt.

The list of papers presented was published in our issue of Oct. 19, but is repeated here for convenience.

Capacity Test of a Unique Form of Air Pump. By F. Meriam Wheeler, Esq., Member.
Interchangeability of Units for Marine Work. By W. D. Forbes, Esq., Member.
The United States Experimental Model Basin. By Naval Constructor D. W. Taylor, U. S. N., Member.
The Composition and Classification of Paints and Varnishes. By Prof. A. H. Sabin.
Tests of the Electric Plants of the Battleships Kearsarge and Kentucky. By Naval Constructor J. J. Woodward, U. S. N., Member.
Coaling of the U. S. S. Massachusetts at Sea. By Spencer Miller, Esq., Associate.
Notes on Recent Improvements in Foreign Shipbuilding Plants. By Assistant Naval Constructor H. G. Gillmor, U. S. N., Member.
Can the American Shipbuilder under Present Conditions Compete with the British and German Shipbuilders in the Production of the Largest Class of Ocean Passenger and Freight Steamships? By George W. Dickie, Esq., Member of Council.
Classification Rules. By Theodore Lucas, Esq., Member.
Recent Designs of Battleships and Cruisers for the U. S. Navy. By Chief Constructor Philip Hichborn, U. S. N., Vice-President.
A Comparison of the Contract Prices of our Naval Vessels. By Harrison S. Taft, Esq., Associate.
Launch of a Cruiser and a Battleship. By James Dickie, Esq., Member.
The Safety of Torpedo-boats at Sea and in Action Under Various Conditions. By Naval Constructor Lloyd Bankson, U. S. N., Member.

More or less complete abstracts of some of these papers will be published in this or later issues.

At the dinner Mr. Amos Cummings, of New York, spoke to the toast of the navy and pledged himself to do all that he could while he remained in Congress to increase the number of battleships. He was followed by Col. A. W. Snowden, Col. J. J. McCook, Mr. Louis Nixon, Admiral C. H. Loring (retired), Mr. Stevenson Taylor and Mr. W. L. Capps.

Train Delays.

At the October meeting of the Pacific Coast Railway Club a report was presented on "Train delays, their causes, cost, responsibility for and remedies." It is necessarily very long, as any railroad man will understand. We print part of it this week, and shall conclude it next week. Even that part which we use now is cut down about half from the text of the committee, not because they said irrelevant or superfluous things, but because it seems inexpedient to take the space to print it in full. The committee consisted of Messrs. W. E. Amann, J. A. Muir, C. H. Quereau, L. S. Pratt, E. L. McKellips, E. A. Gilbert, R. S. Goble, H. C. Whiting, E. E. House and W. H. Norton.

Train delays may be classified under two headings, viz., Terminal Delays and Delays En Route. Terminal delays are the result of various causes.

TERMINAL DELAYS.

Delayed Orders for Power.—A train is frequently ordered to leave at a stated hour. The Master Mechanic is notified that an engine will be needed, and is given twenty or thirty minutes to get the engine ready and on the train. In this twenty or thirty minutes a crew must be called, etc., all of which will consume from one to one and one-half hours. Result, delay of one hour charged against Mechanical Department on account of engine not being ready. This is usually followed by several days of correspondence, with an endeavor to locate responsibility for a delay that did not occur. Practical men in operating departments of railroads know that at least one hour and a half should be allowed to prepare an engine for starting out with an ordinary train. Errors of this nature lead to difficulties that at times interrupt the train service of an entire division, from the fact that the train despatcher having figured on certain meeting points for other moving trains may have to change his calculations and delay several of them to accommodate the late train.

Another terminal delay is frequently charged to car inspectors. A train is made up and is reported ready, which means that the cars are switched together and the caboose put on. After half an hour passes, and reason for delay is asked for, the reply is, "Waiting for car inspectors." Immediately a delay is charged against car department. A train should not be reported as ready until the conductor knows that the train has been examined, the brakes tested, and is in condition to pull out. Orders should not be issued until after the train is reported ready by the conductor in charge.

Improper Switching.—Improper and careless switching is often responsible for serious delays at terminals. Draft rigging and couplers being broken and cars damaged in various other ways, necessitating the switching out of cars from the train and substituting others, or having to wait for car repairers to repair the damage caused by the careless switchman. There is probably no other cause that is responsible for as many delays at terminals as rough handling of cars.

Lack of Power.—Lack of power is ofttimes responsible for delays at terminals, it being frequently the case in busy seasons for yards to be blocked waiting for engines to move freight that has accumulated through the so-called lack of power. This question, however, can be best discussed further on as causes for shortage of power will be shown to be the result of bad practices and poor methods of handling trains.

DELAYS EN ROUTE.

Engine Failures.—Some of the principal, the most annoying, and, with the exception of wrecks, washouts and landslides, the most expensive sources of delays to trains, are those classed as "engine failures." Delays of this nature, in addition to the expense entailed by extra fuel consumed, extra wear and tear on motive power, rolling stock and track incidental to the highest speed required to be made by all trains affected by the delay (saying nothing of fines incurred and business lost) still further increase operating expenses by increasing the cost of repairs, and where engines are disabled, by requiring relief engines with crews to be run light from distant points which tends towards further delays to trains en route and additional expense in making up the lost time.

The engine failures on a certain road for a period of six months have been roughly tabulated. This road, partly mountain and partly valley, comprises over 750 miles of main and branch lines on which are operated locomotives of various classes, from the 15 in. x 22 in. cylinder (eight wheeler) to the largest locomotives in through main line service in the world, many of the different classes being of a compound type. These failures have been grouped under seven different heads.

Under these heads of the total number of failures 11 7-10 per cent. were air failures; 11 7-10 per cent. boiler failures; 30 per cent. hot bearings; 10 per cent. not steaming; 2 per cent. netting choking up; 1 6-10 per cent. lubricator failures, and 33 per cent. machinery failures. Of the machinery failures, 8⅛ per cent. were due to the compound mechanism of the compound type of engine. While a large percentage of these failures can probably be classed as unavoidable, there are always a few which, by a thorough system of co-operation of all concerned should be eliminated. The question arises—how is a co-operation to be effected that will so systematize and harmonize the work of operating departments that the responsibility for these failures can be properly located and measures taken to prevent repetitions. Under the prevailing system of operating power it is painfully difficult to trace causes and fix the blame for many of the failures. A full and complete report from both engineers and conductors of every delay on the road and a searching investigation by officials of departments involved, with the prompt and vigorous enforcement of discipline for the guilty individual, would, in a measure, tend to decrease the number of failures and relieve the minds of the engine and train crews of that feeling which inclines towards lack of responsibility and begets indifference.

Hot Boxes.—The matter of over-heated journal bearings seems to be one of the chief causes of train delays, especially on passenger trains. Most of these cases can be avoided by proper care and attention on the part of those connected with the car department. Passenger equipment should leave terminal yards in such condition that hot boxes should be of rare occurrence. In the first place, the journals should be known to be smooth and free from flaws of any kind; next, the packing employed should be of good quality, saturated with the best oil the market affords; but of most importance, is the method of properly applying this packing to the oil boxes. We often hear the expression, when speaking of the various grades of men employed in car work, "from the oiler up." The oiler is of as much importance as the inspector, or, in fact, any class of men who are employed in any terminal yard. The simple matter of placing oil and waste in an oil box and removing a journal bearing when it is worn out and replacing it with a new one, by no means constitutes an oiler. He should know by experience how long a journal bearing should run from its appearance on inspection. He should know the results of using waste that is not dripping with oil. In other words, he should know that it is not necessary to have a portion of the contents of the oil box clear oil to have a journal bearing run cool. He should also know how much or how little waste to place in the box and at what part of the box it should be placed. A great many oilers force too much waste in the box, some put too much in front, but a majority put too much on the sides of the journal. None of the packing should be allowed above the center line of the journal. That in the extreme back end of the box should be packed very tightly unless some dust guard is used which will effectually keep out the dust, in which case it is not necessary to pack the back of the box any tighter than any other part of it. Enough waste should be put in the box so that it will not settle from the journal, but under no circumstances should it be crowded in so tight that the surface will become glazed from the friction of the journal and thus prevent the oil from feeding freely through the waste to the journal. It is as bad to have too much waste in the oil box as it is to have too little. It is also bad practice to place a quantity or a ball of waste in the box at the end of journal covering the entire end, as many oilers are in the habit of doing. It is useless to put any waste high up on the side of journal. Many crowd the waste so that some comes in contact with the journal bearing key. This method not only leaves an unnecessary quantity of waste to absorb what oil may be used, but leaves the waste so near the journal bearing key that threads are liable to be drawn underneath the bearing, which, in almost all cases, will result in a hot box.

In order to avoid hot boxes, the bearing on the journal should be even. The trucks should be so built that the bearing will not come on the back part of the journal on account of having the equalizer spring seat out of line. The matter of having the equalizer spring seats in line and level is one of the most important about the truck. If the equalizer becomes worn at the point of contact with the top of oil box, this throws the bearing on one end of the journal or the other (generally the back end) which causes an excessive amount of friction on that end and increases the weight per square inch of bearing to a point so high that the lubricating material cannot be drawn between the bearing surfaces, which will, of course, result in hot boxes. We believe that fewer hot boxes will occur where the M. C. B. axle is used, than is the case where the so-called Pullman axle is used. The use of the Master Car Builders' axle has a tendency to keep the truck in better shape. The severe end thrust from the end of the journal against the Pullman wedge has a tendency to disturb the relations between the journal bearing and the journal.

Hot Pins, Etc.—Hot pins, eccentric straps, engine truck bearing and driving boxes are the bane of the engineer's life, and are among the chief causes for delays to trains charged as engine failures. Probably 30 per cent. of the engine failures reported can be attributed to these accidents. Locating the responsibility for these failures is somewhat difficult, especially where engines are run in a pool. In the majority of cases hot pins are the result of poor oil cups or inattention on the part of the engineer. It may be safely stated that 90 per cent. of the hot pins are caused by the oil feeding out of the oil cup within a short time after being filled; no attention is given to it until it is smoking, then it is too late.

There is but one way to treat a main rod bearing that has been heated to a temperature that will melt the babbitt, and that is to reduce the brasses sufficient to permit boring out and give them a new bearing. Put pin in proper condition, by turning with pin machine; examine oil cups and know that feeder is in condition to allow the oil to flow direct to pin, and in a quantity sufficient to lubricate, but not so freely that it will not supply the bearing over the division. The amount of oil necessary to run a main rod pin is not great, and any ordinary sized cup will hold enough. The Pennsylvania Railroad has lately done away with cup feeders. They simply pack the cup with woolen waste in quantity sufficient to prevent the oil from feeding too rapidly, and this stops all monkeying with feeders.

Hot engine trucks or driving boxes are not so frequent as hot pins, but are somewhat worse to handle on account of the crude methods for lubricating them. While some roads have adopted oil cups for the trucks and oil pipes leading from the cab to top of driving boxes, there are very few engines equipped in this way. The old style of oil cellar and the saturated packing on the top of the box are still used. We know of no other part of railroad equipment that show less progress than the method of engine truck and driving box lubrication. It is not difficult to find causes for the heating of these parts. They are invariably the result of neglect on the part of employees whose duties it is to give them attention. The packing is allowed to get foul, drop away from the journals, oil holes get stopped up with cinders. Brasses are improperly fitted to journal, when engine is turned out of the shop and are often allowed to run too long. Poor adjustment of carrying gear, causing unequal weight on top of driving boxes, springs and hangers out of line, twisting the boxes on journal, weak springs, insufficient clearance between boxes and driving wheel hub, wedges badly adjusted, too much lead for valves, causing excessive compression and therefore excessive exertion on driving axle. Engine trucks give very little trouble if they are properly fitted up. Brasses designed with one-inch babbitt strips, oil holes kept clear, packing in cellar and on top of box given attention and inspected every trip. These brasses, if a good babbitt metal is used, will run from one to two years without renewing strips, and the hot engine reports will be comparatively few. It may be said without fear of contradiction that the hot engine truck is the result of neglect.

Overloaded Trains.—Within the past few years the tonnage system of handling trains has taken the place of the old style of number of cars to train, and the prevailing idea with railroad managers seems to be that tonnage must be hauled irrespective of time schedule or the movement of power, and so far, we have been made better acquainted with the resulting evils than with the great benefits that are said to accrue from the change. We know of and are constantly getting reports of delayed trains, "Poor engines," "Incompetent engineers," "Poor coal," etc., being the alleged causes for delays. An investigation often discloses the fact that some overloaded engine has given out; flues have started leaking, and it has been necessary to take some intermediate side track to avoid delaying some passenger train. Too much attention cannot be given this question, as on it often depends the successful operation of trains and power over the entire system of very large railroads.

Many causes have come to the observation of your committee where on account of excessive tonnage rating.

trains have consumed from 24 to 36 hours, and sometimes even more than this, in getting over a division of 250 miles. The natural consequence of this kind of railroading was, and always is, yards blocked with cars, trains strung all along the division, engine and train crews worked to death, which necessitates the hiring of a lot of tramp railroad men, whose only interest in their work consists of inquiries for the "pay wagon." An epidemic of accidents follow, engines and cars are damaged, freight destroyed, and the plaintive cry of the Superintendent and Master Mechanic is heard for more power. The merchants are complaining about delays to freight, especially those who always want their freight "yesterday." The shortage of power resulting from delayed trains, as above referred to, is both serious and costly. When we consider the question from a practical standpoint, and see clearly how much of this could be avoided, it is startling. The wonder is that such a policy is followed, when the evidence plainly shows that it is both extravagant and demoralizing. Probably no better illustration of the loss than that of the over-time paid to engine and train crews, and consumption of coal while lying on side tracks can be given. The following figures are an approximate of what might accrue by delays to trains, the cause for which can be attributed to overloaded trains.

Over-time paid to engine and train crews for one month, 20,000 hours:

Engineers, at 40 cents per hour.....	$8,000
Firemen, at 25 cents per hour.....	5,000
Conductor, at 30 cents per hour.....	6,000
Brakeman, at 20 cents per hour.....	8,000
Total	$27,000

A total for 12 months shows 140,000 hours, or at the same rates an expenditure of $189,000 paid out to crews for over-time for one year. Taking the question of fuel consumption into consideration, we find, by allowing 100 pounds of coal per hour of delay (which is a very conservative figure), that for the 20,000 hours overtime in one month, 1,000 tons of coal were consumed; this, at $4.50 per ton, amounts to $4,500, or for the period of 12 months above quoted, there was consumed $31,500 worth of coal. A total expenditure for over-time and fuel for one year of $220,500.

Taking 14 hours as a day's work for an engine, which, at 18 miles per hour, will cover a division of 250 miles, we find that for 20,000 hours of delay we have 14 engines out of service for one day, or for the period of 12 months, with 140,000 hours over-time, we have 100 engines out of service for one day. Figuring 25 cars to the train, and one train moved over the division every 14 hours, we have 2,500 cars that could be moved. Had trains moved promptly and the over-time been avoided, we are satisfied no complaints would have been heard about shortage of power, but had there been, the $220,500 paid out in over-time and wasted fuel would purchase 18 locomotives, costing $12,000 each.

Engineer Failures.—If the question of engineer failures were segregated and analyzed, and the charges for delays made to the individual as is the case with engines or cars, it would probably lead to a closer attention on the part of engineers who ofttimes escape criticism and censure when they are, through carelessness or incompetency, responsible. So we might advise and believe it would prove beneficial if we had other columns in the bulletined lists of train delays and causes. For instance, we might have a column headed, "Engineer Failures."

(To be continued.)

TECHNICAL.

Manufacturing and Business.

The Russell Snow Plow Co. has ordered one additional snow plow from the Illinois Car & Equipment Co.

The 500 furniture cars ordered recently by the Missouri Pacific from the American Car & Foundry Co. will be equipped with the Shickle, Harrison & Howard Iron Co.'s cast steel trucks and bolsters.

The National Car Coupler Co., of Chicago, has opened an Eastern office in New York city at 150 Broadway, where it will be represented by S. A. Stevenson. Mr. Stevenson was for years connected with the Wabash Railroad.

The corporate name of the Brown Hoisting & Conveying Machine Co. has recently been changed to the Brown Hoisting Machinery Co., Incorporated. The works of the company are at Cleveland. Mr. W. A. Stadelmen is Manager of the Eastern office in the Havemeyer Building, New York city.

The Torsion proof car roof, made by F. W. Bird & Son, will be used on the 700 cars recently ordered by the Armour car line, on 500 refrigerator cars for the Atchison, Topeka & Santa Fe, and on 200 cars building for the California Fruit Express Co. In all of these cars the Neponsit insulating paper will be used.

The Iroquois Iron Works, South Chicago, Ill., are increasing the capacity of their plant by the addition of a number of new buildings, including a boiler house, engine house and cast house and large coke and limestone bins. The contract for all the steel frame construction and plate iron work was awarded to Wm. B. Scaife & Sons, Pittsburgh, Pa., who have the buildings well under way.

Iron and Steel.

Pig iron, according to a Birmingham (Ala.) dispatch has advanced in that district 50 cents a ton. Pittsburgh advices report that Bessemer pig has advanced 25 cents a ton.

The leading makers of steel plates recently held a meeting in New York City, after which it was announced the price of plates was advanced from 1.25 cents to 1.35 cents f. o. b. Pittsburgh.

The American Bridge Co. has a contract to furnish over 700 tons of structural steel for the New York Navy Yard, naval powder depot near Dover, N. J., and to the naval magazine at Iona Island, N. Y.

The Agent General for Victoria, Hon. Sir Andrew Clarke, at 15 Victoria street, London, Eng., is asking bids on 15,000 tons of rails, and 1,500 tons of fish plates, the bids to be received until Dec. 10.

The steamer Monk Haven cleared on Nov. 10 from Conneaut, Ohio, with a cargo of steel billets for Avonmouth, Eng., by way of the Welland Canal. This is the first vessel to carry steel from a lake port to England.

The first blast furnace of the Dominion Iron & Steel Co., at Sydney, N. S., will blow in in a few days, to be followed soon by the second stack. Two other furnaces and the steel plant are to go into operation next spring.

Bids will soon be asked by the Belgian Railroad Administration, No. 12 Rue Henry Beyaert, Brussels, for 320,000 pounds of cast steel, 1,000,000 pounds of drawn iron, 275,000 pounds of fine grain iron and other material.

The American Steel & Wire Co., on Nov. 7, resumed operations at two plants which have been closed for more than four months. They are the Twenty-sixth street, Pittsburgh, or Hainsworth plant, and the Edith furnace, employing about 600 men.

Orders for rails were reported placed during the week by the following companies: Illinois Central, 53,000 tons; Erie, 35,000 tons; Chicago, Burlington & Quincy, 70,000 tons; Southern, 10,000 tons; Louisville & Nashville, 10,000 tons; Cleveland Street Railways, 30,000 tons.

The Pratt & Whitney Co. filed articles of incorporation in New Jersey Nov. 13. The company will build an iron and steel plant in Connecticut. The capitalization is $2,750,000, and the incorporators are: K. K. McLaren, C. W. Perkins and M. M. Solomon, of Jersey City.

Application for incorporation has been made by the New Brighton Steel Co., to make iron and steel. The following are the officers: President, J. J. Blake; Secretary and Treasurer, C. Kiffin; others interested are, Francis Walker, Pierce Reel, Clarence Barnick. The general office is Beaver Falls, Pa.

A Rail Mill in Alabama.

The Tennessee Coal, Iron & Railroad Company is building a rail mill at Ensley, Ala., in connection with the new steel works at that place. This, of course, will be an open hearth plant and will be the first example in the United States of rolling open-hearth rails in commercial quantities.

The Reno Inclined Elevator.

In our issue of Nov. 9 we described the Reno inclined elevator as installed on the Manhattan Elevated Railway at Fifty-ninth street and Third avenue. Our attention is called to the fact that the statement is made in the article that the inclination of the elevator is at an angle of 42¼ deg. The specification from which the note was taken said that the grade is 42¼ per cent. Mr. Reno informs us that all of his elevators are built at an angle of 25 deg. We also said that it takes a longer time to go up on the elevator than to go up by stairs. Mr. Reno assures us that "a person walking with an effort will find himself at least 8 ft. in the rear of one who uses the elevator on gaining the station platform, both having begun the ascent at the same time. The actual speed of this elevator is 110 ft. a minute." Our writer took the actual time occupied in going up on the elevator and by the stairs and found that he went up quicker by the stairs, but it is possible that he is unusually agile or that the elevator was not running at its normal speed when he observed it.

Railroad Material for Italy.

The Italian authorities have appropriated 8,480,000 francs for the purchase of rails, rail joints, etc., for the lines on the mainland, for the current fiscal year, and the Mediterranean company is in the market for 18 modern express locomotives; it will soon ask for bids for 18 passenger cars, 90 baggage cars, 300 closed and 1,000 open freight cars.

German Contract for the American Bridge Co.

The American Bridge Company has just closed a contract with the North German Lloyd Steamship Company, calling for the erection of two steel buildings on the Weser at Bremen, Germany. The machine shop building will be 100 ft. in width and 300 ft. in length, two stories in height. The foundry building is 75 ft. in width and about 600 ft. in length. The contract was secured in competition with the German bridge shops, and is a great triumph for the American Bridge Company.

Emergency Work on a Big Shaft.

The Bethlehem Steel Company recently received an order from the Anaconda Copper Mining Co. of Anaconda, Mont., for a hollow-forged, fluid-compressed steel shaft 17 ft. 10 in. long and 15¾ in. to 20 in. diameter with a 7 in. axial hole, to replace a shaft which broke in the hoisting engine of the mine, necessitating a shutdown until the new one could be received. The new shaft was machined complete within fourteen days from receipt of order. It weighed about 12,000 lbs., and was shipped to Anaconda by express in a special car.

Automatic Block Signals From Bound Brook to White Haven.

It is reported in the New York daily papers, apparently with a good foundation for the report, that the Central of New Jersey has given the order for automatic block signals to equip its line from Bound Brook, N. J., to White Haven, Pa., 113 miles.

Engine Performance on the Los Angeles Terminal Railway.

The Los Angeles Terminal Railway has 52 miles of standard gage track and seven oil-burning locomotives. The following figures are taken from the performance sheet for August: Total engine mileage 22,751, of which 14,049 miles were passenger, 7,264 switching and 1,438 freight. The total car mileage was 84,723; total barrels of fuel oil used, 2,480.5; average miles to one barrel of fuel oil, 9.17; average miles to 200 gals. of fuel oil, 43.80. The average miles run to one pint of cylinder oil and one pint of engine oil are 50.33 and 31.95 respectively. One pound of waste averaged 82.28 train miles. Oil, tallow, waste and "other supplies" cost .4 cent per engine mile; repairs, 2.09 cents; fuel, superintendence and maintenance of equipment chargeable to repairs, cost jointly 13.22 cents a mile; water, .15 cent; engine and roundhouse, 3.91 cents. The total expense of maintaining and operating engines was $4,501.04, an average of 19.78 cents a mile for the total mileage of 22,751.

Friction Buffers.

The Pennsylvania Railroad Co. has given to the Westinghouse Air-Brake Co. an order for 5,400 sets of friction buffer equipment. One condition of this order is that 2,400 sets may be cancelled and that 1,000 may be added, making the ultimate order range from 3,000 to a possible 6,400.

THE SCRAP HEAP.

Notes.

F. M. White, a brakeman, has sued the Chicago Great Western in Iowa for damages for the loss of fingers while engaged in coupling two cars, one of which had not an automatic coupler. The suit will be based on the law forbidding the use of non-automatic couplers.

On Nov. 13 the telegraph operators of the Santa Fe lines west of Albuquerque struck for an increase of pay, and for reduction of working hours in certain cases. The officers of the company and the leader of the Operators' Brotherhood came to an agreement about the time that the strike took effect, so that it lasted only half an hour.

About two months ago Mr. I. A. Sweigard, until recently General Superintendent of the Philadelphia & Reading, was charged with having dismissed employees of the road because they were members of the Brotherhood of Railroad Trainmen, and he was held for trial before the United States Grand Jury; but on Tuesday of this week, when the Grand Jury met, the bills against Mr. Sweigard were ignored.

The boiler makers employed in the shops of the Boston & Albany have been striking, or threatening to strike much of the time, for several months past, the principal grievance being apparently an objectionable boss at Springfield. Finally, at a conference in Boston last week between Mr. Bliss, who now acts as Agent for the New York Central in the management of the railroad, and the representatives of the Boiler Makers' Union, a basis of settlement was agreed upon. It is said that the Massachusetts State Board of Arbitration was present at the conference and that questions which cannot otherwise be settled are to be submitted to the decision of this Board.

Traffic Notes.

Officers of the Illinois Central announce that that road is to have a regular steamship line from New Orleans to London and Hull.

A compartment sleeping car is now run on the Southwestern Limited Express between New York and New Orleans over the Southern Railway.

The annual meeting of the Guarantee Ticket Brokers' Association was held at Cleveland Nov. 14, and J. A. Webb, of Chicago, was elected President.

The new Transcontinental Passenger Association held its first regular meeting at St. Louis Nov. 20, Chairman James Charlton presiding. Mr. E. L. Bevington was chosen Secretary of the Association.

The Atchison, Topeka & Santa Fe announces that this season the California limited trains of that road will be supplied daily by telegraph with the closing quotations from the Chicago Stock Exchange.

Interests connected with the New York, Ontario & Western have secured a large future increase in the coal traffic of the road by purchasing additional coal lands. This action has been taken, it is said, with a view to securing territory which otherwise would become tributary to the proposed new railroad from the anthracite regions to the Hudson River, the Kingston & Delaware Valley.

Certain Southwestern roads have notified their conductors to be careful to collect half fare, in every case, from children five years old and under 12; and the circular reminds them that the parent or guardian accompanying a child has made an implied contract with the road to pay the child's fare; so that if payment is refused the conductor may rightfully put both parent and child off the train, even though the parent pays, or offers to pay, for himself.

The Freight Committee of the Trunk Line Association met in New York City this week and once more

resolved to have tariff rates on westbound freight strictly maintained. The daily newspapers of New York have lately printed innumerable rumors of irregularity in rates, many of which were charged to agents of the roads west of the trunk lines. All of the reports appear to have been based on a very few facts and it has been impossible to make out what degree of importance should attach to them, or how many facts are still undiscovered.

The League of Commercial Organizations, which met in St. Louis Nov. 20, passed a resolution asking Congress to promptly pass the Cullom bill (No. 1439) which gives enlarged powers to the Interstate Commerce Commission. The memorial to Congress says that this measure affects more citizens than any other now pending before Congress; and that it has been discussed by the public for a year and with almost unanimous approval by the press. The League believes it to be a wise and judicious measure which will remedy the defects in the present law. The Chairman of the Executive Committee, Mr. E. P. Bacon, of Milwaukee, said that action would be taken to send many delegates to appeal to Congressmen in the interest of the Cullom bill. Resolutions were passed recommending each local commercial body to send one or more such delegates to Washington when Congress meets.

Interstate Commerce Commission Hearing at New York.

The Commission met in New York last week to consider the question of rates on grain, and other matters. Mr. Frank Harriott, Joint Grain Agent, at New York City, of the railroads bringing grain from Buffalo, testified concerning the rates on traffic from the Lakes. He has held his present office but a few months. Before he took charge, rates were demoralized, the published price on grain from Buffalo to New York being three cents a bushel, while the railroads were actually carrying the freight at 2.5 and 2.25 cents. The price has now been raised to four cents, and is maintained. Witness believed that a five-cent rate could have been maintained a part of the time. He believed that the combination of elevators at Buffalo helped to keep vessel rates low, by preventing delays in unloading.

Mr. Guilford, Traffic Manager of the New York Central, when asked to testify about the agreement between the roads concerning the grain traffic from Buffalo to New York declined to do so, on the ground that the traffic referred to was not interstate. One elevator at Buffalo, the Kellogg, is not in the Elevator Association. The Central had refused to receive grain from this elevator. The Central, on all grain which it carries from Buffalo to New York, pays the Association five mills a bushel. Two of the elevators in the Association are owned by the New York Central.

Mr. Joyce, Freight Traffic Manager of the Pennsylvania, replied to a complaint of Brooklyn consignees that the Pennsylvania has discontinued carrying hay to its station at North Fourth street, Brooklyn. The road has made this change because the station was overcrowded. The complaint appears to have originated with the shippers, who alleged that their market was destroyed; to this Mr. Joyce replied that the hay could be delivered at the Palmer dock.

The Commission took up the subject of underbilling of freight, and heard testimony concerning the examinations of packages made by inspectors at the freight houses in New York. Mr. Stevenson, inspector for the Trunk Lines, said that 15,000 to 20,000 shipments were found in New York each month, which were wrongfully described or reported at too light weight. Mr. Blye, General Agent of the Trunk Lines, thought that these unlawful classifications, which amounted to over 4 per cent. of the whole of the shipments, would, if not corrected, mean a loss to the railroads of $18,000 to $20,000 a month.

The Michigan Tax Commissioners and the Railroads.

The State of Michigan has created a Board of State Tax Commissioners for the purpose of appraising properties paying specific taxes.

Prof. M. E. Cooley (University of Michigan) is the appraiser for the board, and has had a corps of engineers, numbering about 100 men, in the field all summer and fall making careful notes of the railroad properties. Mr. H. E. Riggs is the Chief Engineer in charge. Some time since they appointed an expert to take up the signaling and interlocking. This department is in charge of Mr. Moore, engineer of the Railroad Commission. Mr. Cooley has also secured the appointment of a Board of Review to consider the detailed reports made by the several departments so as to arrive at a final determination. It has been his purpose to keep this matter entirely out of politics by securing the services of individuals fitted for the special work, and most of them are from outside of the State of Michigan. This Board of Review is as follows: Mr. O. Chanute, Chicago; Mr. Charles Hansel, New York; Prof. Chas. E. Greene, Ann Arbor; Major C. W. Vaughn, Chicago.

The Seaboard Grain Traffic.

Mr. John K. Cowen, President of the Baltimore & Ohio, speaking at a meeting of the New York Chamber of Commerce Nov. 20, said:

"The great city of New York is proposing, if I read the papers aright, to have another transportation interest, and which you call a deep waterway—a deep waterway canal. You have set about it with your imperial wealth; you say New York's commerce must be protected, her commercial supremacy is threatened, and we will get another transportation interest, notwithstanding the magnificent ones we have.

"What do you want another transportation interest to the Atlantic seaboard for? You say your commerce is slipping away. What commerce do you expect to carry to this city that is not carried already? When you come to sift it, it is grain and the meal products of grain.

"Where do you expect to divert it from? Not from Galveston and New Orleans, I take it. You expect to take it from Norfolk, Newport News, Baltimore and Boston. And what do you propose to take away? One hundred and sixty-three million bushels of grain, 112,000,000 bushels of which was corn. In the year 1900 there was nearly as much wheat went through a Baltimore & Ohio elevator from the bay counties of Maryland and the bay counties of Virginia as came from all the balance of the United States. Baltimore held on to its corn, and was the largest corn exporter in the United States."

Chinese Railroads.

The extent of the work done on each of the railroads in course of construction in China before the Boxer outbreak, is described by the different Commissioners of Chinese Customs in the districts concerned. The Commissioner at Niu-chwang says that by the end of last year the Eastern Chinese line from Port Arthur and Ta-lien-wan and the junction for Niu-chwang was finished, while the Imperial Chinese Railway from Tientsin to Niu-chwang was practically completed, except a bridge near Niu-chwang, or rather Ying-kau, its port. By these systems Niu-chwang obtains access all the year round to Ta-lien-wan and to Ching-wang-tan, close to Shan-hai-kwan. The continuation of the Chinese line northeastward to Hsin-min-tun, the terminus as at present planned, was being vigorously prosecuted; the Russian line was finished as far as Mukden and it was hoped to reach Harbin, the junction with the line from Vladivostock across Manchuria to Irkutsk by the end of the present year. It is said that over 200,000 Chinese workmen were employed on the line. The Commissioner of Tientsin speaks of the double track on the line to Pekin having been finished during the year, while on the Lu-han line trains were running to Pao-ting-fu, 80 miles from the Pekin terminus. The Commissioner at Han-kau says of the southern end of the Lu-han line that an embankment was completed for 80 miles from Han-kau, and rails laid on 27 miles of this, and by May last it was expected that materials for the line would be conveyed to a place 100 miles from Han-kau, "and at this rate of construction the line as far as Hsin-yang, 346 miles distant, is expected to be in working order in the beginning of 1902." The chief station or depot at the Han-kau end is to be on the front of the Yang-tsze, five miles below the town, where a stone quay is to be constructed and the rails carried along it for the convenience of loading and discharging steamers. Two other stations are to be provided, one behind the foreign concessions, and another on the Han River, for passengers chiefly. The route of the projected line from Han-kau to Canton has been surveyed, and the contract to build it is said to have been secured by an American syndicate, but work has not been commenced. As to the extension of the Tong-king line, which runs north from Hanoi through Langson to the Chinese frontier, the Commissioner of Lung-chau says that nothing is being done on the Chinese side. "My predecessors for the last few years closed their reports with more or less sanguine hopes that the next year would see the beginning of serious work; but I regret to say that up to the present moment nothing but surveys and estimates have been completed." He adds that, after protracted negotiations, an agreement was lately concluded between the Chinese Government and the Compagnie de Fives-Lille for the building of a line from Lung-chau to Nam-Kuan. The preliminary surveys and estimates have been completed, and if no unforseen obstacle arose the work was to have been commenced at once, some of the staff being on the spot early in the present year. The progress made towards a railway from Tong-king by Lao-kai and Meng-tsze to Yun-nan city has recently been described in these columns in an account of the condition of French trade with Southern China.—*The Times, London.*

Belgian Season Tickets.

Mention has been made heretofore of the season tickets issued in Switzerland and Wurtemburg good for a fortnight on all railroads of those countries. Such tickets have this year been introduced in Belgium on the State Railroads, which this year for the first time include nearly all railroads in the Kingdom. The cost is $7.66 second class and $4.42 third-class. (There is no first-class.) The purchaser deposits a dollar which he forfeits unless he returns the ticket by noon of the day after its time has expired. The ticket is good over some 3,000 miles of railroad, but there is no such temptation to go over all the lines as there is in Switzerland; and commercial travelers probably are the chief customers for them.

A Royal Saxon Car.

A new car is to be built for the use of the King and Queen of Saxony, which is insofar American in design that it is 65 ft. long, with two six-wheel trucks, vestibule platforms and entrances at the ends. It is equipped with Westinghouse, Henry and Hardy brakes, probably to enable it to go over all German lines; has an electric safety signal and pneumatic whistle signal apparatus; hot-water heating apparatus, which may be used with a heater on the car or by steam from the locomotive; and is lighted by both gas and candles. The chief apartments for the royal travelers are a drawing room and two bedrooms, with dressing rooms. The other compartments are for the attendants. The Breslau Car Works is building it.

The German Car Famine.

The annual car famine in Germany set in as usual last October, when the sugar beets must all be carried before freezing weather, and the winter stock of coal is shipped. The greatest pressure is felt at the coal mines of the Ruhr district (near the Rhine at Dusseldorf), which has been the greater because extreme low water in the Rhine has greatly limited river shipments. The railroads carried for the first 24 days of October 8½ per cent. more coal than last year, and had furnished as many as 17,060 cars in a day, but the orders for cars had reached 18,000 per day. They boast, however, that they have been only 6,621 cars behind their orders this year, against 11,960 last year.

Fast Run on the Canadian Pacific.

A fast run was made on the C. P. R. the morning of Nov. 12 with a special train carrying Lord Strathcona from Montreal to Ottawa. The train left Windsor Street Station at 8:37 a. m., and reached Ottawa at 10:27 a. m., a distance of 111.4 miles in 110 minutes. At least 10 minutes should be deducted from this, however, for slow running through Windsor street station yard at Montreal and the central station yard at Ottawa, and for reducing speed at four interlocked grade crossings, and at Ste. Annes and Vaudreuil to receive and deliver the electric train staff. The train consisted of Atlantic type engine 210, one coach and the private car "Metapedia."

Nicaragua's Canal.

A Washington dispatch of the 16th says: "Senor Corea, the Nicaraguan Minister, who has just returned from consultation with his Government, was at the State Department early this morning and had a short conversation with the Secretary of State in regard to the Nicaragua Canal. Nicaragua is anxious to initiate negotiations with the United States for an arrangement by which this Government will secure a right of way across Central America for the canal, and Senor Corea is expected to submit a definite proposition soon. It is said that it will guarantee the United States a free right of way across Nicaragua on the payment of a large sum of money, about $5,000,000, and an annual rental. Concerning the Eyre-Cragin canal concession, Mr. Corea is reported to have said the Nicaraguan Government had declared officially that this concession was nullified, in accordance with the provisions of the contract. The old concession, he said, had ceased to attract attention. "So that," he added in conclusion, "I am happy to say Nicaragua is free to negotiate with any one concerning the canal, and especially the Government of the United States."

American Steel for Suspension Bridge Wire.

American steel is being used more and more for purposes for which foreign steel was used exclusively a few years ago. A case in point is that of the steel being used in the wire for the New East River Bridge which is being drawn by the John A. Roebling's Sons Co., of Trenton, N. J. The Roeblings formerly bought imported Swedish steel for making this class of wire. After exhaustive experiments they found that acid open-hearth steel as made by the Carbon Steel Company would meet their requirements, and an order for 6,000 tons was placed by the Roebling concern with the Carbon people. The steel has proved so satisfactory for making the wire for the bridge that the question is now under consideration of substituting for the No. 8 called for in the specification No. 6, which has been found will carry 230,000 tensile strength. About 4,000 tons of wire will be required for the New East River Bridge, but the Roebling concern has placed an order with the Carbon Steel Company for 6,000 tons of steel.—*The Iron Age.*

Saving Coal.

Having assembled certain of his firemen, a motive power official of a western road is said to have called their attention to the importance of small things by the following forceful illustration: A shovelful of coal, he said, weighs from 16 to 18 lbs. and costs the road 2 cents. As the company has an average of 500 locomotives on the road all the time, it can be shown that if every fireman would save one shovelful of coal an hour, the annual gain to the company would amount to $80,000.

Crane Company's Exhibit at Paris.

The exhibit of the Crane Company, Chicago, at the Paris Exposition attracted much attention and the company was awarded a gold medal. Visitors to the Palace of Machinery and Electricity, where this exhibit was installed, saw a great variety of brass and iron valves and cocks for all pressures, brass and iron fittings, steam specialties, engineers' supplies and steam and gas fitters' tools. It was also a good opportunity to study modern American methods of piping and flange work for power plants; this class of equipment having become a very important branch of the Crane Company's business.

Railroads in Japan.

Consul-General Bellows forwards from Yokohama, Oct. 3, 1900, the following: The total length of all railroads in Japan at the end of the thirty-second fiscal year (the 31st of March, 1900) was 3,635 miles 42 chains, of which 832 miles 73 chains belonged to the Government and 2,802 miles 49 chains to the private companies, showing increases of 64 miles in the governmental railways and 159 miles in the private railways, a total of 223 miles compared with the figures of the preceding fiscal year. The total length allotted to the principal owners is as follows:

	Miles.
Government railroad	749.3
Hokkaido Governmental railroad	83.42
Total	832.72
Nippin	857.07
Kyushu	330.18
Sanyo	280.65
Hokkaido Colliery	207.06
Kanasi	148.24
Hokuriku	84.52
Sobu	71.77
Kankaku	68.33
Hoshu	52.75
Others (under 50 miles)	701.72

There are at present 14 companies with the total capital of 169,900,000 yen ($84,610,200), and this, added to the governmental outlay, makes the whole amount invested in railroads in Japan 250,000,000 yen ($124,500,000). If all the debts of the companies and capitals of those companies which have not yet opened to railroad traffic were added, it would amount to more than 300,000,000 yen ($149,400,000).

The total income from the governmental and private railroads in the thirty-second fiscal year was 38,210,000 yen ($19,028,580), of which 24,460,000 yen ($12,250,800) were passenger receipts, 12,690,000 yen ($6,319,620) goods receipts, and 1,050,000 yen ($522,900) miscellaneous receipts.

The average number of locomotives, passenger cars, and luggage cars per mile is as follows:

	Locomotives.	Passenger cars.	Luggage cars.
Kyoto	0.46	1.51	4.38
Shin-etsu	0.35	0.62	3.54
Hokuriku	0.24	0.83	2.45
Nippon	0.33	0.94	3.86
Kyushu	0.46	0.02	10.77
Sanyo	0.3	1.15	3.36
Hokkaido Colliery	0.25	0.38	5.35
Kansal	0.36	1.83	3.45
Sobu	0.26	1.11	3.2
Hoshu	0.38	0.96	11.24

Lectures on Steel Forgings.

Mr. H. F. J. Porter, of the headquarters staff of the Bethlehem Steel Company, on the evenings of November 20 and 27, will address the classes of the Brooklyn Institute of Arts and Sciences in the public lecture course, his subjects being, "The Development of the Forging Industry" and "Modern Methods of Making Steel Forging," respectively. On November 24 the lecture last mentioned will be repeated before the German Technical Society of Philadelphia, and on Saturday evening, December 8, Mr. Porter will exhibit before the Winter Conversazione of the Franklin Institute in that city turnings made by tool-steel treated by the "Taylor-White Process" which the Bethlehem Company is exploiting.

Lord Kelvin on Aluminum Conductors.

The already practically foreshadowed widening use of aluminum conductors for electric transmission purposes adds interest to Lord Kelvin's recently expressed opinion of them. The weight of aluminum required, he said, is almost exactly one-half of the copper which would produce the same effect. The diameter of cable is 28 per cent. in excess of one made of copper, and the cost of insulation for an underground cable is increased in about the same proportion when we pass from copper to aluminum. Aluminum is not a pleasant metal to deal with, but its high conductivity will make it invaluable for overhead transmission. It is true also that the weight to be supported on posts is half of copper, but the surface exposed to the wind is greater, and its strength is not great. The chief drawback to its use, especially overhead, is its liability to become rotten. This defect does not exist if the metal be pure, and especially if free from sodium. But exposure to the atmosphere, especially near the sea, induces deterioration. The fact that aluminum is easily oxidized ought not to condemn it. The same is true of iron and steel, and yet we do not hesitate to place structures of these metals in exposed positions. Only we paint them; so Lord Kelvin proposes that we paint or varnish aluminum conductors wherever necessary. A few hundred yards of 1¼-inch aluminum wire were put up by Lord Kelvin on a Scotch estate somewhat over a year ago, and on this line he is watching the effects of weather.—*Cassier's Magazine.*

Tunnel from Gibraltar to Morocco.

Consul Monaghan, of Chemnitz, under date of Oct. 13, 1900, informs the State Department that a Parisian engineer has recently finished a plan according to which the Spanish railroads terminating in Gibraltar will be connected, by means of a tunnel crossing under the Strait of Gibraltar, with the railroad lines of Morocco. Several of the men interested in the scheme are now in Morocco trying to obtain permission to build a railroad in that place. Of course, our readers know that this is a very ancient scheme, and will not look for its speedy completion.

Work to Be Begun on the Guatemala Northern.

Richard Barthel, of Snyder, Barthel & Co., secretary and treasurer of the Central American Improvement Co., left New Orleans for Puerto Barrios, Guatemala, to take charge of the Guatemala Northern, which is to be repaired and extended to Guatemala. (Nov. 9, p. 745.)

New Bonds for the Northern Railway of Costa Rica.

An issue of $1,600,000 first mortgage 5 per cent. gold bonds has been authorized by the Northern Ry. of Costa Rica. This line is now completed for 41 miles from Port Limon, on the Gulf coast, and is building for 24 miles more to the lands of the United Fruit Co. The fruit company owns all of the $1,000,000 capital stock of the railroad, and guarantees the interest and sinking fund of the mortgage. E. H. Rowlins & Sons, of Boston, Mass., and the Manhattan Trust Co., New York, offer $1,000,000 of the bonds at 97¾ with interest. The other $600,000 has been sold.

A New Russian Railroad.

The U. S. Consul writes from Chemnitz, under date of Oct. 13, that a railroad is proposed to make direct connection between St. Petersburg and Odessa. The two cities are now joined by a line which makes a wide bend requiring 49 hours to make the distance. The new road will be only 1,500 kilometers (about 930 miles) long and would lessen the distance about 248 miles, and reduce the time of traveling to 27 hours. It would bring Kief into direct communication with the capital.

Martin Irons.

Martin Irons, who led the Missouri Pacific strike in 1886, died recently in Texas. He was born in Scotland March 1, 1832, came to New York with his parents when he was 14, and learned the machinist's trade. He appears to have been an unsuccessful man in his private affairs and irresponsible in domestic affairs, his wife having left him because of cruelty and non-support. Apparently, he was precisely of the material of which agitators are made.

A Technical School for Pittsburgh.

On the 15th Mr. Carnegie announced in a letter to the Mayor of Pittsburgh that he would endow a technical school, to be established in that city, with $1,000,000 in 5 per cent. bonds. He requests that the trustees of the Carnegie Institute take charge of the affairs of such a school.

Fifteen Passengers Killed in France.

Press despatches of Nov. 15 report that the Southern Express from Madrid to Paris was derailed at St. Vincent de Tirosse, about 33 miles northeast of Bayonne, France, and that the whole train fell down a bank and was overturned, being badly wrecked. Thirteen persons were killed outright and about 20 others were injured. Among those fatally hurt was Mr. J. F. Canevaro, the Minister from Peru to France. The reports state that the train was running at 75 miles an hour, and that probably the derailment was due to insecure track, the accident having occurred at a point where repairs were going on.

Boston Harbor Improvement.

At the November meeting of the Boston Associated Board of Trade, President John R. Carter spoke of the proposed harbor improvements as follows: "The width of the Broad Sound channel was to be 1,200 ft., its depth 30 ft. With that width and depth little ledge was encountered. But we asked for a channel 2,000 ft. wide and 35 ft. deep. The survey shows that to carry this out the almost prohibitive expense of $10,000,000 would be entailed. A width of 1,500 ft. could be secured at about half of this cost. It is probable that the report will go in on the 'alternative route,' which takes a more northerly direction through Broad Sound channel. If it is adopted a width of 2,000 ft. can be had through President Roads, and a width of 1,500 ft. toward the city, at a cost of about $6,000,000. I urge the members to use all their personal and organized influence to secure an appropriation from the Harbor and River Commissioners for this work."

Compressed Air.

The Board of Directors of the Compressed Air Co. met last week at the offices of the company, No. 621 Broadway, New York. Among those in attendance were Thomas Dolan, William L. Elkins, Henry D. Cooke, General C. H. T. Collis, Newell C. Knight, William H. Kimball and General G. E. P. Howard. The equipment of another cross-town line with compressed air was discussed. Three sub-companies are in organization to introduce air cars in Ohio, Missouri and New England. The board passed a resolution authorizing the listing of the stock of the company on the New York Stock Exchange.

LOCOMOTIVE BUILDING.

The Minneapolis & St. Louis is reported in the market for six locomotives.

The Pittsburgh & Lake Erie is reported in the market for more locomotives.

The New York, Chicago & St. Louis has ordered five switch engines from the Brooks Locomotive Works.

The Missouri Pacific has ordered 44 freight and six passenger locomotives from the Brooks Locomotive Works.

The Pittsburgh Locomotive & Car Works have an order for a number of locomotives for export—we believe for India.

The Chicago & Eastern Illinois is in the market for some 12-wheel freight engines. The number about to be ordered is stated to be 12.

The Intercolonial of Canada has ordered 20 locomotives from the Canadian Locomotive & Engine Co. The works have been bought by William Harty, of Montreal, and will be reopened at once.

The Wheeling & Lake Erie, as noted last week, is in the market for five consolidation locomotives. These will weigh 280,000 lbs., with 166,000 lbs. on drivers, and have 22 in. x 28-in. cylinders; 57-in. driving wheels; boilers of the Belpaire type, designed to carry 200 lbs. steam pressure, and to have 354 tubes 2 in. in diam. and 13 ft. 8 in. long; the fire-boxes will be 10 ft. long x 40½ in. wide, of Carbon steel. The tank capacity for water will be 5,000 gals., and the coal capacity 11 tons. The special equipment will include Westinghouse brakes, National hollow brake-beams, Tower couplers, Ohio injectors, U. S. metallic packing, Consolidated safety valves, Leach sanding devices, Michigan lubricators and A. French springs.

CAR BUILDING.

The Wabash is in the market for 50 passenger cars.

The Erie has ordered 25 passenger coaches from the Wason Car Mfg. Co.

The American Car & Fdy. Co. has an order from a private line for 10 tank cars.

The Sebastacook & Moosehead has ordered six freight cars from the Laconia Car Co.

The Wheeling & Lake Erie is reported in the market for 500 box and 500 coal cars.

The Rodger Ballast Car Co. has ordered 56 ballast cars from the American Car & Fdy. Co.

The Atchison, Topeka & Santa Fe has ordered 11 postal cars from the American Car & Foundry Co.

The Lake Street & Northwestern Elevated, of Chicago, is reported in the market for more equipment.

The Central of New Jersey has ordered 26 cars for passenger service from the Barney & Smith Car Co.

The Cleveland, Cincinnati, Chicago & St. Louis is reported in the market for 2,700 freight cars, of which 700 will be coal.

The New York, Chicago & St. Louis has placed an order with the American Car & Foundry Co. for 500 box and 300 coal cars.

Harlan & Hollingsworth have an order for a number of freight and passenger cars for export. We understand they are to go to South America.

The Chicago, Rock Island & Pacific is in the market for 100 furniture cars, and will build 200 box and 200 stock cars at its Horton, Kan., shops.

The Chicago & Eastern Illinois has ordered from the Pullman Co. 200 box cars of 60,000 lbs. capacity, and 500 coal cars of 80,000 lbs. capacity. It has also ordered from the Mt. Vernon Car Mfg. Co. 300 box cars of 60,000 lbs. capacity, and from the American Car & Foundry Co. 500 coal cars of 80,000 lbs. capacity. All of these cars will be equipped with Bettendorf body and truck bolsters.

The Cleveland, Cincinnati, Chicago & St. Louis has placed an order with the Barney & Smith Car Co. for four 70-ft. parlor cars, 12 70-ft. coaches and four 70-ft. combination cars. The parlor cars will have all the modern conveniences, such as buffet, smoking rooms and ladies' retiring room; and the interior finish will be mahogany and marquetry decorations. The coaches will seat 88 people, have ladies' and gentlemen's saloons and wash stands; the interior finish will be cherry with marquetry decorations. The combination cars will seat 50 people and have a baggage space of 30 ft. These cars will be equipped with six-wheel trucks, having 36-in. steel-tired wheels. All the cars will be equipped with Westinghouse air-brakes and National hollow brake-beams. A direct system of steam heat will be used and the cars will have wide vestibules and an empire deck in the roof. It has not yet been decided what system of lighting will be used.

BRIDGE BUILDING.

Allentown, Pa.—We are informed that bids will probably be wanted, in December, by R. I. Rathbun, Chief Engineer, for the proposed steel bridge over the Little Lehigh River and the Lehigh Valley R. R., and Allentown & Auburn R. R. The bridge will oe built by the Allentown & South Allentown Bridge Co., and will be 1,750 ft. long, with 2,200 ft. of approaches. It will be of Pratt trusses set on towers 80 ft. high. The estimated cost is $200,000.

Billings, Mont.—We are informed that bids are wanted by the Board of County Commissioners, on Dec. 3, for a combination bridge 480 ft. long over Yellow River, near Billings. It is to be of three spans on tubular piers. Bidders are to furnish plans and specifications.

Brighton, Pa.—See Other Structures.

Buffalo, N. Y.—We are informed that bids will probably be wanted in a few weeks for a bridge to be built on Delaware avenue, over Scajaquada Creek. F. V. E. Bardol, Chief Engineer, Department of Public Works.

Burnside, Conn.—A committee has been appointed to report, Dec. 15, on the advisability of replacing the present old wooden bridge in Brunswick with a steel structure.

Cleveland, Ohio.—Proposals are wanted at the office of the clerk of the Board of Control, 105 City Hall, until noon of Dec. 12, for building the steel superstructure of the bridge at Middle Seneca street over the Cuyahoga River. A certified check for $5,000 must accompany all proposals. John Vandevelde, Deputy Director of Public Works. Plans can be had from the Chief Engineer.

Cohoes, N. Y.—We are informed that the New York Central & Hudson River R. R. has under consideration the elimination of a grade crossing at Cohoes, which will involve the building of a three-track one-span bridge.

Davenport, Iowa.—The ordinance for elevating the tracks of the Chicago, Rock Island & Pacific is again before the Council. Besides elevating the tracks in the city, the ordinance provides for a new passenger depot between Main and Harrison streets to be not less than 36 x 160 ft. and two stories high.

Duquesne, Pa.—The proposition to issue $20,000 of bonds for a bridge over Patterson Hollow has been carried.

Fredericton, N. B.—The Chief Commissioner of Works wants bids for the superstructure of a bridge at Upper Corner, Sussex; for the Bostwick's bridge, Big Salmon River, and the Tobique Narrows bridge; also for rebuilding Taxin River bridge in York County.

Hamilton, Ont.—An engineer is reported making estimates for the necessary bridges on the proposed extension of the Hamilton, Grimsby & Beamsville R. R.

Harrisburg, Pa.—The Common Council, on Nov. 12, passed an ordinance to build a subway under thre Pennsylvania and the Philadelphia & Reading tracks at Market street, to eliminate the grade crossing at that place.

Helena, Mont.—Local reports state that the Northern Pacific will fill in a number of trestles and replace two wooden bridges with steel viaducts, each about 800 ft. long and 125 ft. high.

Jeffersonville, Ind.—We are informed that the County Commissioners want bids, on Dec. 4, for three iron bridges. Address Geo. W. Badger, County Auditor.

Middletown, N. Y.—We are informed that the Erie R. R. is about to build a bridge at Genung street for the New York, Susquehanna & Western.

Milwaukee, Wis.—The Milwaukee Architectural Club has extended the time, until Nov. 27, for submitting plans for the new Grand avenue bridge.

Monroeville, Ohio.—Reports state that a bridge proposed by the Toledo, Fremont & Norwalk Electric Ry. will cost about $22,000. W. A. Comstock, Secretary, Fremont, Ohio.

New York, N. Y.—Mayor Van Wyck has approved the ordinance passed by the Municipal Assembly providing for a permanent bridge across Blackwell's Island and over East River, from Sixtieth street, Manhattan, to the foot of Charles street in Queens. This ordinance was passed by the Council on May 1, but has been held up by the Board of Aldermen.

A hearing was given last week on the application of the Manhattan Elevated R. R., to build a bridge at 180th street, connecting with the storage yards.

Pittsburgh, Pa.—Seven bids were received by Director Geo. W. Wilson, of the Department of Public Works, for building the South Tenth street bridge. Each company made two bids, the first providing for the use of the Carnegie Company's special shaped plates, and the second for the usual channel shape floor plates. Following are the bids received: McClintic-Marshall Construction Co., $308,000 and $301,000; Nelson & Buchanan Co., $263,500 and $255,700; C. L. Stroble, $291,500 and $286,500; Jutte & Foley Co., $270,000 on either proposition; King Bridge Co., $299,900 and $304,000; American Bridge Co., $279,000 and $271,000; Drake & Stratton Co., $315,000 on either proposition. Nelson & Buchanan got the contract. The new bridge will be 1,420 ft. long, 40 ft. wide and 55 ft. above pool level. It will have a 20-ft. roadway and two sidewalks. The longest span will be 290 ft., the other three each 225 ft.

The wooden bridges on the Lowgrade division of the Pennsylvania between Redbank and Driftwood are to be replaced by steel structures. The American Bridge Co. has contracted to build seven steel bridges.

Scranton, Pa.—Mayor Moir has signed the ordinance for a viaduct on West Lackawanna avenue from Seventh street to Ninth street, over the tracks of the Delaware, Lackawanna & Western R. R. The entire cost of the viaduct will be paid by the D., L. & W., and the Scranton Ry. Co. (Sept. 7, p. 601.)

Seabright, N. J.—The Board of Chosen Freeholders have accepted the plans made by Wyncoop & Braly for a drawbridge over the South Shrewsbury River at Seabright, at a cost of $65,000. Bids on these plans are asked by the Board until Dec. 5.

Terryville, Conn.—The grade crossing of the Highland division of the New York, New Haven & Hartford at Terryville in the town of Plymouth will be eliminated. The Railroad Commissioners, on Nov. 14, considered plans made by the railroad for an iron bridge and for moving the passenger station, the total cost of which is placed at $33,940.

Verona, N. J.—We are informed that the Erie R. R. is about to build a bridge on the Caldwell Branch at Bloomfield avenue, Verona.

Waco, Tex.—J. W. Riggins, Mayor of Waco, will consider plans, until Dec. 17, for building a bridge across the Brazos River. In our last Supplement we reported that a bridge was contemplated between Washington and Elm streets, to be 300 ft. long, 60 ft. wide and to have two sidewalks and permit of an electric railroad in the center of the roadway. Estimated cost, $100,000.

Watervliet, N. Y.—A contract for the State bridge over the Erie Canal at Twenty-third street is let to the Owego Bridge Co., at $13,147.

Waverly, N. Y.—The Erie R. R., we are informed, is about to let a contract for a bridge to carry Spaulding street over the Erie and the Lehigh Valley tracks.

Westfield, N. J.—The Central R. R. of New Jersey is considering abolishing the grade crossing at Westfield by building a bridge over the tracks at Osborn avenue.

Other Structures.

Brighton, Pa.—The Pittsburgh & Lake Erie bridge across Beaver River, at Brighton, will necessitate some important changes. The grade crossing will be abolished, and a new central passenger station will be built.

Cedar Rapids, Iowa.—The Illinois Central has bought property for a site for a new freight depot to be built at a cost of $80,000. Plans for a $40,000 passenger station are reported made.

The Chicago & Northwestern, it is reported, will spend about $250,000 for property and building a new freight depot in Cedar Rapids.

Chester, Pa.—The Penn Steel Casting & Machine Co. is preparing to make extensions to its plant. A new machine shop will be built.

Davenport, Iowa.—See Bridge Building.

Detroit, Mich.—Fire in the Detroit Bridge & Iron Works, on Nov. 14, caused a loss of about $65,000.

Du Bois, Pa.—The plans for the new foundry buildings to be built at this place, which were made by Wm. E. Bloodgood, 149 Broadway, New York City, provide for a storehouse 220 x 250 ft., plating shop 220 x 140 ft., cleaning room 140 x 60 ft., boiler and engine room 50 x 70 ft., moulding shop 150 x 310 ft., wash house 38 x 60 ft., cupola room 35 x 60 ft., pattern shop 30 x 60 ft., coal storage 50 x 240 ft., together with a number of other shop buildings. Bidders are asked to submit proposals on either wood frame or steel construction. There will be a stack 150 ft. high and 6 ft. in diam. There will also be a reservoir with a capacity of 140,000 gals.

Frenchman's Bay, Me.—The Bureau of Equipment, Navy Department, Washington, D. C., has contracted

with Snare & Triest, 39 Cortlandt street, New York, for a new coal station at this place to cost $269,900.

MEXICO CITY, MEX.—The large steel car house and power house, recently finished by the Federal District Street Ry. Co., will be enlarged to twice its capacity.

NEW ORLEANS, LA.—Vice-President and General Manager L. S. Thorne, of the Texas & Pacific, is reported as stating that his road will soon begin work on building a 1,000,000 bushel grain elevator, and also build an additional 3,000 ft. of wharfage at Westwego, La.

PITTSBURGH, PA.—The Oliver Iron & Steel Co. is reported to have bought additional land adjacent to the Borough of Elizabeth, where new works will be built.

PRESCOTT, ONT.—The Canadian Pacific Ry. has approved plans to enlarge the station buildings both for freight and passenger accommodation at Prescott and Brockville. The station improvements, with enlargement of the yard accommodations, will cost about $100,000 and will be undertaken early in the spring.

RANKIN, PA.—Surveyors are at work on a site for the new bridge works to be built by the McClintic-Marshall Construction Co., of Braddock, on the river front between the Duquesne forge plant and the mill of the American Steel & Wire Co.

SAN FRANCISCO, CAL.—The San Francisco Dry Dock Co. has let a contract to the City Street Improvement Co. to build its large dry dock at Hunter's Point at a cost of $404,000. Work was begun on Nov. 19 and is to be finished in 18 months. The dry dock will be built of granite and will be of the following dimensions: Length, 750 ft.; width, 127 ft. at top, 74 ft. at bottom.

SPRINGFIELD, OHIO.—We are informed that the Cleveland, Cincinnati, Chicago & St. Louis is considering building a new depot in Springfield, but that nothing definite is decided.

SUMMERVILLE, S. C.—Plans are reported made for a new passenger station in Summerville for the Southern Ry.

MEETINGS AND ANNOUNCEMENTS.

(For dates of conventions and regular meetings of railroad associations and engineering societies see advertising page xi.)

Association of Civil Engineers of Cornell University.

A regular meeting of the Association of Civil Engineers of Cornell University will be held on Friday, Nov. 23.

New York Railroad Club.

The meeting of the New York Railroad Club, held Thursday evening, Nov. 15, was the annual meeting. The following officers were elected:

President, H. H. Vreeland.
First Vice-President, W. W. Wheatly.
Second Vice-President, A. M. Waitt.
Third Vice-President, W. F. Potter.
Treasurer, C. A. Smith.
Executive Members, A. E. Mitchell, G. W. West, W. W. Snow.
Finance Committee, R. M. Dixon, Wm. B. Albright, F. P. Huntley.

The subject of discussion was "Are six-coupled locomotives necessary for trains running 100 miles without a stop?" There was no paper, the discussion being entirely verbal. The sum of the discussion was that the question is special and local, that many trains of considerable weight and speed are run 100 miles and more, with single driver engines, while in other cases the grades, loads and speeds are such as to require the adhesion of six drivers coupled.

The Car Foremen's Association of Chicago.

The regular monthly meeting of the Car Foremen's Association of Chicago was held in the Monadnock Building, Chicago, Thursday evening, Nov. 8. At this meeting twenty were elected to membership. Mr. Grieb of the Chicago, Milwaukee & St. Paul, presented an interesting review of the decisions of the M. C. B. Arbitration Committee up to date, showing the proportion of cases presented by the different roads and the number each won and lost.

The following case in dispute was discussed: A receives one of his cars home with B's repair card attached covering one bottom arch bar. A finds that the arch bar is wrong, it being wrongly shaped so that the pillars do not fit properly, also that this arch bar has been cut by the wheel between the oil box and the pillar bolt, previous to the application to this car, which made it unfit for anything but scrap. For this A procured joint evidence card and made request on B for a defect card. B replied that the arch bar applied by him was new and of proper shape and dimensions when applied, and declines to issue defect card. A states that the car bore no evidence of other recent repairs to any of the trucks, and desires to know whether the joint evidence in this case is final and makes it obligatory upon B to issue a card. It was unanimously decided that as B's repair card was on the car covering the application of an arch bar, on which A procured proper joint evidence card, he was responsible for the wrong repairs and should furnish A with his defect card.

In the matter of a car delivered to a connecting line with the air hose torn off, after a great deal of argument on both sides the motion was carried that the delivering line should furnish a defect card for the missing coupling and the party making repairs should bill the owner for the rubber air hose.

A Mr. C. L. Bundy, of the Swift Refrigerator Line, presented a paper on "Hot Boxes, Their Causes and Cures," which will be discussed at the next meeting.

PERSONAL.

(For other personal mention see Elections and Appointments.)

—Mr. Robert E. Hamil, General Attorney for the Baltimore & Ohio Southwestern, died Nov. 15, at Phoenix, Ariz. Mr. Hamil was 45 years old, born in Alabama and was graduated from McKendree College.

—Mr. F. C. Fletcher, who recently resigned as Auditor and General Freight Agent of the Deckerville, Osceola & Northern, has become Traffic Manager for the lumber firm of Chapman & Dewey at Kansas City, Mo. Mr. Fletcher is a son of J. J. Fletcher, Traffic Manager of the Kansas City, Ft. Scott and Memphis.

—Mr. Frederick Gossman, Auditor of the Ann Arbor, died recently. Mr. Gossman was 45 years old, born in Sandusky, Ohio, and entered railroad service as clerk in 1880 on the Toledo, Ann Arbor & North Michigan, now Ann Arbor. He was steadily promoted and in 1895 became Auditor and Assistant Treasurer of the Ann Arbor.

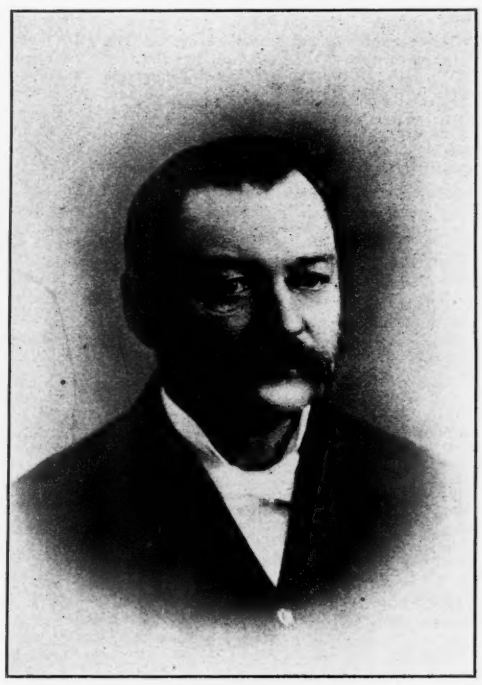
—Mr. Edward V. W. Rossiter, who was recently appointed Vice-President of the New York Central & Hudson River (p. 763), was born July 13, 1844, at St. Louis, Mo. In 1859 he became clerk to the President of the Hudson River and the following year clerk in the Treasurer's office. Then in 1867 he went with the New York & Harlem as Cashier and served in this capacity for 10 years. In June, 1883, Mr. Rossiter became Treasurer of the New York Central & Hudson River.

—Mr. Llewellyn Le Conte, C. E., of the Department of Civil Engineering of Columbia University, died at his home, 495 Fourth street, Brooklyn, last week of typhoid fever. Mr. Le Conte was a graduate of the Columbia School of Applied Science, and was an instructor in the summer school of geodesy at Osterville, Mass., last summer. Later in the year he was appointed assistant in the school of surveying at Litchfield, Conn. The trustees of Columbia University in October promoted him to the rank of assistant in civil engineeering in the University School of Applied Science, which position he held at the time of his death.

—Mr. W. M. Kinch, Superintendent of Signals of the New York Central & Hudson River, with headquarters at the Grand Central Station, New York City, was born in Franklinville, Huntingdon county, Pa., April 12, 1856. His first railroad service was with the Pennsylvania R. R. at Altoona as an apprentice in the machine shops. He went to Pittsburgh in 1884 as Supervisor of Signals of the Pittsburgh Division. This was at the time when the electro-pneumatic signals were just being installed there. He continued in that work until May 1, 1892, when he became Supervisor of Pneumatic Signals on the Harlem Division of his present company, the New York Central. On May 1, two years later, he took charge of all the signals on the Hudson and Harlem divisions, with the title of Assistant Superintendent of Signals, in which capacity he continued until Nov. 1 last.

—Mr. George C. Smith is to be General Manager of the new St. Louis-Louisville division of the Southern, which will include the Louisville, Evansville & St. Louis Consolidated under the reorganization. Mr. Smith, who is now President and General Manager of the Atlanta & West Point and the Western Railway of Alabama, was born in Granville, Washington County, N. Y., March 4, 1855. He was graduated at Adrian College, Mich., in 1877, and for three years following was private secretary to Hon. C. M. Croswell, the Governor of Michigan. He entered railroad service in 1881 as secretary to the General Manager of the International & Great Northern and the Texas & Pacific. The following year he entered the service of the Missouri Pacific and continued with that company until May, 1893. He served until 1889 as secretary to the First Vice-President of the system, and then until 1893 as assistant to the First Vice-President. From January to May, 1893, he was Assistant General Manager of the system, and also General Manager of the Kansas City, Wyandotte & Northwestern. Since September, 1894, he has been President and General Manager of the Atlanta & West Point and the Western of Alabama.

—Mr. George B. Reeve, the former General Traffic Manager of the Grank Trunk, is to succeed Mr. Charles M. Hays as General Manager on Jan. 1. Mr. Reeve has just returned to Montreal from California where he went in May last after forty years continuous service in the Grand Trunk System. When he went away he expected never to return to his old company. But the call to the higher place was not then among the probabilities. Mr. Reeve was born Oct. 23, 1840, in the County of Surrey, Eng. He entered railroad service with the Grank Trunk in his twentieth year as freight clerk at Montreal. He was telegraph operator in 1862 and 1863, and Train Dispatcher until 1865. From 1866 to 1873 he was Station Agent at Montreal, when



he received the appointment of Assistant General Freight Agent. He continued in that capacity until 1881, when he was made Traffic Manager of the company's western line, the Chicago & Grank Trunk. He was also Traffic Manager of the Chicago, Saginaw & Mackinaw. After serving on the Western lines for six years he returned to Montreal in February of 1896 as General Traffic Manager. His withdrawal from that position in May last was marked by tokens of the regard of his associates. Mr. Reeve's attention through the forty years of his service has been directed almost exclusively to traffic business, and it is probably because of this training that he receives his new appointment.

ELECTIONS AND APPOINTMENTS.

Alabama Great Southern.—A. J. Frazer, heretofore Superintendent of the Birmingham Division of the Southern, has been appointed Superintendent of the A. G. S., with headquarters at Birmingham, Ala. Thos. Bernard has been appointed Engineer Maintenance of Way at Chattanooga, Tenn., effective Nov. 12. Mr. Bernard holds a similar position on the Southern.

Algoma Central.—C. McCarthy has been appointed Assistant Purchasing Agent, with headquarters at Sault Ste. Marie, Ont.

Atchison, Topeka & Santa Fe.—On Nov. 14, the following new Directors were elected: H. Jones, J. C. McCullough and B. L. Smith. They succeed respectively C. K. Holliday and E. N. Gibbs, deceased, and W. Rotch, resigned.

Baltimore & Ohio.—At the annual meeting, held Nov. 19, the following new Directors were elected: J. P. Green (First Vice-President of the Pennsylvania), Charles H. Tweed (Chairman of the Board of the Southern Pacific), and M. Erdman, succeeding J. Kennedy Tod, Henry C. Pierce and A. Brown.

Boston & Maine.—C. N. Chevalier has been appointed Fuel Agent, succeeding J. R. Rooks, resigned.

Chicago & Northwestern.—W. H. Finley has been appointed Principal Assistant Engineer and F. H. Bainbridge succeeds Mr. Finley as Engineer of Bridges. Effective Dec. 1.

Chicago, Milwaukee & St. Paul.—H. T. Griffin has been appointed Assistant General Passenger Agent, with headquarters in Old Colony Building, Chicago, Ill. Effective Nov. 15.

Duluth, Redwing & Southern.—At a meeting, held at Redwing, Minn., Nov. 14, S. B. Foote was elected President, succeeding T. B. Sheldon, deceased, and L. F. Hubbard, Vice-President and General Manager.

Erie & Wyoming Valley.—Alex. M. Lupfer has been appointed Chief Engineer, with headquarters at Dunmore, Pa., succeeding Charles E. Webster, resigned. Effective Nov. 15.

Eureka & Klamath River.—The officers of this company are: President, A. B. Hammond; Secretary and Assistant Treasurer, Geo. W. Fenwick; Treasurer, C. H. McLeod; General Superintendent, C. Sullivan; Auditor, H. Trinwith; and Chief Engineer, R. L. Lathrop.

Grand Trunk.—George B. Reeve, formerly General Traffic Manager, has been appointed General Manager, succeeding C. M. Hays.

Great Northern (Canada).—E. Doucet has been appointed Chief Engineer.

Los Angeles & Salt Lake.—H. M. McCartney, Superintendent and Chief Engineer of the Arizona & Utah, has been appointed Chief Engineer of the L. A. & S. L. (See R. R. Construction column, Nov. 16, p. 764.)

Macon, Dublin & Savannah.—A. L. Moler has been appointed Superintendent and Master Mechanic, with headquarters at Macon, Ga.

Manahawkin & Long Beach Transportation.—At a meeting of the stockholders, held recently, J. K. Shoemaker was elected President and a Director.

Mobile & Ohio.—G. W. McGehee, heretofore Supervisor of Bridges and Buildings at Okolona, Miss., has been appointed Superintendent of Bridges and Buildings, with E. P. Hawkins as Assistant.

Pittsburgh & Western.—R. Finney, Jr., heretofore General Agent and Purchasing Agent, has been appointed Acting General Superintendent.

Rio Grande Western.—S. J. Henry, General Freight Agent at Salt Lake City, Utah, has resigned.

St. Louis Southwestern.—The headquarters of A. B. Liggett, Superintendent of the St. Louis Southwestern of Texas, have been removed from Tyler to Mount Pleasant, Tex. Effective Nov. 17.

Seattle & Northern.—F. E. Ward has been appointed General Superintendent, with headquarters at St. Paul; P. T. Downs has been appointed Assistant General Superintendent, with headquarters at Spokane, and H. E. Byram, Superintendent, with headquarters at Everett, Wash. Effective Nov. 7.

Southern.—C. S. Hayden has been appointed Superintendent of the Birmingham Division, succeeding A. J. Frazer. W. N. Foreacre succeeds Mr. Hayden as Superintendent of the Mobile Division. Effective Nov. 12.

Wisconsin Central.—W. R. Hancock, heretofore Assistant Treasurer, was, on Oct. 31, appointed Treasurer, succeeding Frederick Abbot, retired on account of ill health. F. C. Cleaver has been appointed Superintendent of Motive Power and the Car Department, with headquarters at Waukesha, Wis., succeeding Angus Brown, resigned. Effective Nov. 10. Robert Toombs, Auditor, will also assume the duties of Comptroller, a position recently created.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

ALASKA ROADS.—R. O. Lazier, of Tacoma, Wash., has returned from Nome, Alaska, and is reported on his way to New York to meet members of an English syndicate who are interested in a railroad from Grantly Harbor, near Cape Nome, to run east about 85 miles to Council City in the Golovin Bay District. The company may extend the line on from Council City to Nutalo on the Yukon.

ATLANTIC SHORE LINE.—The Maine State Railroad Commissioners have approved of the location of this electric line in Biddeford. It is to run from Biddeford southeast 27 miles along the ocean via Kennebunkport and Wells to York. Percy Richard, of Portland, Me., is Chief Engineer.

BRUNSWICK & BIRMINGHAM.—Application has been made for a charter in Georgia for a line connecting Brunswick, Ga., with Birmingham. The estimated length is 450 miles and the capital stock $750,000. C. Downing and F. D. Aiken, of Brunswick, Ga., are interested.

BOONE, ROCKWELL CITY & NORTHWESTERN.—See Marshalltown & Dakota.

CANADIAN PACIFIC.—Extensive improvements are proposed in the passenger and freight yards at Prescott and Brockville, Ont.

CHICAGO & NORTHWESTERN.—An officer confirms the statement that the company has organized the Peoria & Northwestern to build from Peoria, Ill., north about 84 miles to Nelson, on the main line. (Nov. 16, p. 764.)

As to double tracking the company's main line between Chicago and Council Bluffs, Iowa, he writes that it is expected to have a continuous double track in operation by Dec. 15 next, from Chicago to Maple River Junction, Iowa, 400 miles, with the exception of the section between Boone and Ogden, where a change in alignment is being made, and a complete new double track line, involving a viaduct across the Des Moines River, 2,600 ft. long, is being built under the title of the Boone County. (Construction Supplement, July 27, 1900.)

The extension of the Belle Plaine branch from Muchakinock, Iowa, southwest to Weller, has been completed and the company's engineers are surveying from Weller to Corydon, on the Keokuk & Western, about 32 miles. It is understood that a further extension is to be made from Corydon to Spring Valley in Decatur County, near the southern boundary of the State, and from thence into Missouri. The ultimate terminus is understood to be Kansas City.

CHICAGO, ROCK ISLAND & PACIFIC.—Building is reported resumed on the branch from Andarko, Okla. T., south 30 miles to Fort Sill. Grading was completed for 16 miles some time ago. (Construction Supplement, July 27, 1900.)

CHILCAT & KLAHIM RIVER.—John Irving, of Victoria, B. C., has given notice of application to the Legislature of British Columbia to incorporate a company to build from the junction of the Chilcat and Klahim Rivers and northerly in the direction of the Dalton trail to some point not less than five miles from the Provincial boundary in the District of Cassiar, B. C.

CINCINNATI, RICHMOND & MUNCIE.—The company has notified the Secretary of State of its intention to increase its capital stock from $50,000 to $870,000. It is building from Richmond, Ind., to Muncie, 43 miles. (Construction Supplement, July 27, 1900.)

CLEVELAND, CINCINNATI, CHICAGO & ST. LOUIS.—An extension is under contemplation from Aurora, Ind., to Rising Sun, about 8½ miles, approximately paralleling the Ohio River. No preliminary surveys are made yet. (Official.)

CRAWFORD BAY & FORT STEELE.—Whealler & Martin, of Kaslo, B. C., have given notice that application will be made to the Legislature of the Province of British Columbia to incorporate to build from Crawford Bay, on Kootenay Lake, in the District of West Kootenay, B. C., through the valleys of Crawford Creek and the St. Marys River to a point at or near Fort Steele in the District of West Kootenay, B. C.

DENVER & RIO GRANDE.—President E. T. Jeffery is reported from Denver, Colo., as announcing that the branch from Antonito to Villa Grove is to be made standard gage at the Antonito end; also the line from Monte Vista to Del Norte. The whole of the Creede line is ultimately to be made standard gage. (Aug. 31, p. 588.)

DES MOINES & NORTHERN IOWA.—Right of way has been secured from Boon to Britt, Iowa, with the exception of three pieces of land which will be secured by condemnation. Arthur Reynolds, of Des Moines, Iowa, President, has returned from the East and reports all arrangements completed for the issue of bonds. Building will be begun in the spring. (Aug. 17, p. 560.)

DES MOINES, IOWA FALLS & NORTHERN.—Hardin Township, Iowa, including the city of Iowa Falls, and also Buckeye Township, have each voted a 3 per cent. tax in aid of building this line which is projected from Duluth, Minn., south through Iowa Falls and Des Moines, Iowa. Surveys are in progress. Contracts are to be let this winter for grading in the early spring. E. S. Ellsworth, Iowa Falls, Iowa, is President. (Nov. 2, p. 732.)

GRAND TRUNK.—The Central Vermont line has leased the Montreal & Providence line and is rebuilding it from Farnham, Que., southeast 25 miles through Stanbridge East and Frelighsburg to Sheldon Junction, Vt. This section was completed a number of years ago, but has been closed to traffic for about 15 years. The Central Vermont is using the eastern end from Frelighsburg to St. Lambert, opposite Montreal. (Construction Supplement, July 27, 1900.)

GREAT NORTHERN (CANADA).—The bondholders have decided to build the Joliette branch at once, which will take the line into Montreal over a bridge to be built over the River Des Prairies, at the east end of Montreal Island. (Aug. 10, p. 546.)

ILLINOIS CENTRAL.—At the request of the company the City Council of Cedar Rapids, Iowa, last week passed a resolution granting the company right of way for nine blocks through Fourth avenue, through which the Chicago & Northwestern, the Chicago, Milwaukee & St. Paul and the Burlington, Cedar Rapids & Northern have tracks. The condition made by the company was that $200,000 shall be spent in terminals.

It is understood that the company may extend its stub line which runs from the main line at Manchester, Iowa, to Cedar Rapids on via Western, Tiffin, Riverside and Washington to Coppick on the Iowa Central.

IOWA ROADS.—A syndicate of eastern capitalists has been formed, according to report, to build a railroad to be run by electricity or compressed air, from Des Moines east about 30 miles to connect with the Iowa Central at Newton. It is proposed to make an agreement with the Des Moines Street R. R. Co. for entrance into that city.

KANSAS CITY, MEXICO & ORIENT.—Surveys are in progress for the Panhandle & Gulf, which is the Texas incorporation of this line. The road is run from a point on the Red River near Vernon south via Sweetwater, San Angelo and Marfa to Presidio del Norte on the Rio Grande. (Sept. 14, p. 614.)

LAKE BENNETT.—Mr. D. G. Macdonell, of Vancouver, B. C., has given notice of application to the Legislature of British Columbia to incorporate a company to build from a point at or near the Dyea River, on or near the Provincial boundary of the Province of British Columbia and Alaska to a point at or near Lake Bennett, thence to the sixtieth parallel of latitude.

MARSHALLTOWN & DAKOTA.—Hamilton Browne, President, announces the completion of arrangements for the merging of this line into a new line to be known as the Boone, Rockwell City & Northwestern. The plans involve the building of eight miles of line from Fraser, the eastern terminus, to Boone, and also the extension from Gowrie, Iowa, to Rockwell City, 18 miles. (Construction Supplement, July 27, 1900.)

MEXICAN CENTRAL.—Surveys are made for a railroad from Gutierrez, Mex., west about 64 miles to Sombrerete in the State of Zacatezes, where the Sombrerete Mining Co. has extensive mines.

MILWAUKEE, BERLIN & NORTHERN.—The Council of Berlin, Wis., has been petitioned to grant a franchise through the city to this company, which proposes to build from Berlin northwest about 50 miles to Stevens Point. W. W. Cooper, of Kenosha, is an incorporator. (Oct. 19, p. 696.)

MINNEAPOLIS, ST. PAUL & ASHLAND.—According to press reports from Ashland, Wis., an agreement has been made with the Weyerhauser syndicate to put the road in first-class condition and to newly equip it, and also to build an extension of 10 miles toward Superior. (Construction Supplement, July 27, 1900.)

MISSOURI, KANSAS & TEXAS.—Building is reported begun on a second track between McAlester and South McAlester, Ind. T., about three miles.

NASHVILLE, FLORENCE & NORTHERN.—The City Council of Nashville, Tenn., has adopted a resolution to submit to popular vote the proposition that the city subscribe for $1,000,000 for this proposed line from Nashville north to Louisville, Ky., with an extension from Nashville south and west to some point in Alabama or Mississippi. Jere Baxter, of Nashville, who is building the Tennessee Central, is President. (Construction Supplement, July 27, 1900.)

NEW HAMPSHIRE ROADS.—The Dartmouth Dry Dock & Marine Construction Co., with a capital stock of $500,000, has been registered under the laws of the State.

NEW YORK CENTRAL & HUDSON RIVER.—A contract is reported signed between the Beech Creek line of this company, the Philadelphia & Erie line of the Pennsylvania and the Buffalo, Rochester & Pittsburgh for building a line from Clearfield east about 30 miles to Karthus. This would give the Buffalo, Rochester & Pittsburgh connection with the Philadelphia & Erie, and it is understood that the West Branch Valley line will be abandoned.

Application has been made, according to report, to the city of Buffalo, to lease a strip of the Hamburg Canal 60 ft. wide, from Michigan street to Washington street, which is to be filled in for additional tracks.

NEW YORK, NEW HAVEN & HARTFORD.—An officer writes with reference to the report, widely circulated, that the company will make the line four-track between New Rochelle and the Harlem River north of New York City, that no four-tracking of the Harlem River branch is contemplated at present.

NEW YORK ROADS.—A syndicate has been formed to build the connecting links on an electric line from Albany and Troy, north about 65 miles, to Warrensburg. The village trustees of Glens Falls are understood to have granted right of way and the road will parallel the old plank road between Glens Falls and Lake George. Another proposition is to extend the road on to Scroon Lake in the lower Adirondacks. Some 35 miles of new road will be required to complete the links to Warrensburg. Joseph Powers, of Troy, and Addison B. Colvin, of Glens Falls, are the promoters.

NORTHERN PACIFIC.—The company is reported to have obtained land at Tacoma, Wash., for the proposed terminals.

A report that the company will make expenditures for terminals at Portland, Ore., is declared by an officer to be incorrect. (Nov. 9, p. 748.)

PENNSYLVANIA.—Right of way is reported secured for building about three miles of track east of Frankford Junction at Philadelphia, to do away with a sharp curve.

PENNSYLVANIA COMPANY.—Surveys are reported made for a cut-off of the Cleveland & Pittsburgh between Hudson, Ohio, and Ravenna.

PITTSBURGH, BESSEMER & LAKE ERIE.—The company is reported extending the Hilliard branch from Boyers Station, Pa., north about five miles to Murrinsville, with a branch to Eau Claire to tap coal lands.

PITTSBURGH, CONNELLSVILLE & WHEELING.—Building was begun at Viola, Marshall County, W. Va., Nov. 11, on this proposed line from Connellsville, Pa., west to Wheeling, W. Va. Edgar A. Holmes, of Wheeling, is General Manager. (Aug. 3, p. 531.)

SEABOARD AIR LINE.—Application has been made to the Council at Manchester, Va., to build a connecting line through the city to the Southern Ry. The two stations are about a mile apart.

SHAWNEE, OKLAHOMA & MISSOURI COAL & RAILROAD.—This company has been organized and has surveyed for a line from Guthrie, Okla. T., to Fort Smith, Ark. A treaty is being negotiated with the Indians through the territory the line will pass. It is stated the company has the necessary funds for the first 50 miles. H. B. Dexter, Shawnee, Okla. T., is President.

SOUTHERN PACIFIC.—A large force is reported at work on the Ogden division, shortening the curves, reducing grades and re-laying rails. (Aug. 3, p. 531.)

SULPHUR SPRINGS.—This company, which was incorporated in Oklahoma, Sept. 25, is to build from a point on the new St. Louis, Oklahoma & Southern line of the St. Louis & San Francisco at or near Hickory, Ind. T., to run west about 30 miles through Sulphur Springs to Davis, on the Atchison. Eugene E. White, of South McAlester, Ind., T., is President.

SUWANEE & SAN PEDRO.—The Drew Lumber Co., of Columbia, Fla., writes that work is not yet begun on the extension of this line, but it hoped that operations will be begun shortly. (Construction Supplement, July 27, 1900.)

TEXAS EASTERN.—This company was incorporated in Texas, Nov. 8, with a capital stock of $150,000, to build a railroad from Lufkin, Angelina County, west 50 miles to Crockett, Houston County, connecting the Houston East & West Texas and the International & Great Northern.

TEXAS SOUTHEASTERN.—C. M. McWilliams, of Texarkana, Tex., Vice-President and General Manager of this company, whose incorporation was recently noted (Oct. 19, p. 696), writes as follows, with reference to the line:

The road runs eastwardly from Diboll, Tex., on the Houston, East & West Texas Ry., to Ashford, Tex., a distance of seven miles, thence to Boluxy Junction, a distance of 14 miles, thence over the Texas & Louisiana R. R. Co.'s tracks to Lufkin, Tex. There will be an extension from Boluxy Junction, but we do not expect to do any work on it soon.

T. L. L. Temple, of Texarkana, is President.

TOLEDO & WESTERN.—Track laying is reported in progress for this line, probably electric, between Toledo and Sylvania, Ohio, about 20 miles. The road is projected from Toledo west 38 miles to Adrian, Mich. It is to be completed to Sylvania by Jan. 1. F. E. Seagrave, of Toledo, is in charge of building. (Construction Supplement, July 27, 1900.)

WABASH RIVER TRACTION COMPANY.—C. W. Blakeslee & Sons have the contract for this electric line from Wabash, Ind., to Peru. The work is not difficult. There is one maximum grade of 5 per cent. D. A. Blakeslee, of New Haven, Conn., is President. (Official.)

WESTERN MARYLAND.—The company is reported considering plans for double-tracking the Potomac Valley branch from Cherry Run to Williamsport, Md. Extensive improvements are reported begun on the yards at Williamsport.

WICHITA & SOUTHERN.—This company has been reorganized at Wichita, Kan. It is proposed to build a line from Wichita south via South McAlester, Ind. T., to Denison, Tex. J. P. Wheeler is President under the reorganization; J. O. Davidson, Treasurer; and George Dixon, Secretary. (Construction Supplement, July 27, 1900.)

GENERAL RAILROAD NEWS.

BALTIMORE & OHIO.—At the annual meeting of the stockholders at Baltimore, Md., Nov. 19, the fact was disclosed that new interests have obtained representation in the company in the election of two representatives of the Pennsylvania R. R., and one of the Southern Pacific. Speyer & Co., New York, also have a representative. Other railroads already represented on the Board are the Great Northern, the Union Pacific and the Northern Pacific. (Nov. 2, p. 732.)

BURLINGTON, CEDAR RAPIDS & NORTHERN.—Stockholders may subscribe at par for new stock to the amount of 30 per cent. of their present holdings. The transfer books will re-open Dec. 11.

CHICAGO & ALTON.—The New York Stock Exchange has listed $17,433,000 of the $31,988,000 C. & A. Railroad 3 per cent. refunding mortgage gold bonds of 1949. Also the following securities of the C. & A. Railway: $22,000,000 of 3½ per cent. first lien gold bonds of 1950; $19,544,000 4 per cent. non-cumulative preferred stock, and $19,452,800 common stock. The remaining refunding bonds unlisted, amounting to $14,555,000, have been sold by the company and are deposited with the U. S. Trust Co., New York, and against these negotiable receipts have been issued in the denomination of $1,000 each, representing the face value of the bonds. These receipts provide that any part of the deposited bonds are subject to sale until July 1, 1901, at 95 and accrued interest. (Aug. 10, p. 546.)

CLEVELAND, CINCINNATI, CHICAGO & ST. LOUIS.—The Central Trust Co., New York, will receive sealed proposals up to noon, Nov. 27, for Cincinnati, Indianapolis, St. Louis & Chicago 4 per cent. mortgage bonds of Aug. 2, 1886, at not to exceed 102½ and accrued interest, the total to consume not more than $78,761.

GREAT NORTHERN.—Negotiations have been completed between the traffic officers of this company and the Union Pacific, whereby traffic arrangements have been made involving the exchange of business, both passenger and freight, at Sioux City, Iowa. The route from St. Paul will be over the Great Northern and the Willmar & Sioux Falls to Sioux City, and over the Chicago, St. Paul, Minneapolis & Omaha to Norfolk, Neb.

MOBILE & BIRMINGHAM.—The New York Stock Exchange has listed the company's $900,000 preferred stock. The voting power on the stock has been assigned irrevocably during the term of the lease to the Southern Ry.

MONTREAL & PROVIDENCE.—See Grand Trunk under Railroad Construction.

NEW ORLEANS & WESTERN.—No bids were received for this property when offered at Port Chalamette, La., Nov. 17. After a similar failure, Oct. 6, the upset price was reduced from $1,000,000 to $100,000, subject to about $600,000 receivers' charges. The court will be asked to make a further reduction of the upset price to $50,000. (Oct. 26, p. 712.)

NEW YORK, ONTARIO & WESTERN.—President Fowler has made the following announcement with reference to several anthracite collieries which have been acquired for his company:

The friends of the Ontario & Western R. R. who are largely interested in the management of the property, have purchased the coal properties of all the individual operators along its line and tributary to it. This eliminates the question of rates in the future and secures to the Ontario & Western R. R. absolutely the territory it has always carried, with some additions. There is no truth whatever in the statement that a readjustment of the stock is now being considered, nor is there any likelihood of a dividend being declared in the near future. The policy of the officers and directors had the indorsement of a large majority of the stockholders.

The cost of the coal properties has been about $6,200,000. The railroad company has authorized the issue of 5 per cent. sinking fund notes to the amount of $3,500,000, dated Dec. 1, 1900, and due in semi-annual installments from 1901 to 1915. The notes are a first lien on the properties of the New York & Scranton Coal Co., the Johnson Coal Co., the Elkhill Coal Co., the Raymond Coal Co., and the Mount Pleasant Coal Co. These properties are said to contain about 27,000,000 tons of coal, of which 23,000,000 tons are under law royalty and 4,000,000 tons in fee simple.

NEW YORK, SUSQUEHANNA & WESTERN.—Eleven Paterson Extension bonds for $1,000 each have been called for redemption at the Central Trust Co., trustee, New York, at 105, on Dec. 1, interest to cease from that date. (Aug. 10, p. 546.)

PERKIOMEN.—The stockholders, on Jan. 14, will vote on a proposal to increase the capital stock from $50,000 to $1,500,000. The road is controlled by the Reading through ownership of stock.

RUTLAND.—Judge Hoyt H. Wheeler, of the U. S. Circuit Court, at Burlington, Vt., handed down a decision, Nov. 19, confirming the motion of O'Brien & Sheehan, the New York contractors of the Rutland-Canadian line, to have the injunctions denied restraining them from further work on the road. The court holds that the railroad company had no right to take possession of the contractors' property and must render an account to the contractors for the use of the same. Counsel for the railroad company has withdrawn the motion to set aside the attachment of the contractors for $500,000 against the Rutland-Canadian. (Nov. 9, p. 748.)